Including Ham Radio Fun!

73® Amateur Radio Today

JULY 1997
ISSUE #442
USA $3.95
CANADA $4.95

International Edition

ATV Special Issue

Rockets & Balloons
Power Supplies
Preamplifiers
Antennas

Reviews:

LDG 'Tenna Tuner
Ramsey's Dr. NiCad

*****5-DIGIT 48103
#00000191901#MR JUN76
UNIV MICROFILM
SERIAL PRCNG ATTNL
300 N ZEEB RD
ANN ARBOR MI 48103-1553

Finally – A Professional-Quality Receiver to Monitor Weather Broadcasts!

NEW **Our new RWX is a very sensitive and selective Hamtronics® grade receiver to monitor critical NOAA weather broadcasts.**

Excellent 0.15µV sensitivity provides good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast.

Essential for airports, police and fire departments, CAP, broadcast stations, state and local emergency managers, amateur repeaters – anyone needing a professional quality receiver. Because of its reasonable price, it is also handy for bikers, hikers, boaters, hunters, farmers – or anyone who needs up-to-date weather info and emergency warnings, even from distant stations.

Small enough for emergency or portable use, it can even be powered from a small 9-12V battery when needed. Crystal controlled for accuracy; **all 7 channels provided** (162.40 to 162.55).

You can buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only $79
- RWX Rcvr kit with cabinet, speaker, & AC adapter $99
- RWX Rcvr wired/tested in cabinet with speaker & adapter $139

WWV RECEIVER

NEW Get time and frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

- **RWWV Rcvr** kit, PCB only **$59**
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter **$89**
- **RWWV Rcvr** w/t in cabt with spkr & adapter **$129**

WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites! A very sensitive wideband fm receiver **optimized for reception of NOAA APT and Russian Meteor weather fax** images on the 137 MHz band.

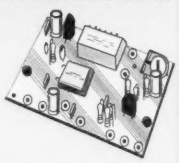
The R139 is lower cost and easier to maintain than synthesized units. And it is designed from the ground up for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all five satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and AC power adapter $189
- **R139 Receiver w/t** in case with AC power adapter $239
- Internal PC Demodulator Board and Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SUBAUDIBLE TONE ENCODER/DECODER

NEW **Access all your favorite closed repeaters with TD-5 CTCSS Encoder/Decoder**

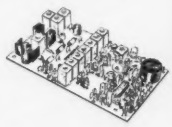


Encodes all standard subaudible tones with crystal accuracy and convenient DIP switch selection. Comprehensive manual also shows how you can set up a front panel switch to select between tones for several repeaters. Receiver **decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver.

- **TD-5** CTCSS Encoder/Decoder Kit ..... only **$39**
- **TD-5** CTCSS Encoder/Decoder Wired/tested **$59**

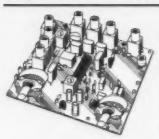
HIGH QUALITY VHF & UHF FM XMTR AND RCVR MODULES

FM EXCITERS: 2W output, continuous duty.



- **TA51:** for 6M, 2M, 220 MHz .. **kit $99, w/t $169.**
- **TA451:** for 420-475 MHz. ..... **kit $99, w/t $169.**
- **TA901:** for 902-928 MHz, (0.5W **out**).....**w/t $169.**

VHF & UHF POWER AMPLIFIERS.
Output levels from 10W to 100W **Starting at $99.**



FM RECEIVERS:

- **R100 VHF FM RECEIVERS** Very sensitive – 0.15µV. Superb selectivity – both crystal and ceramic IF filters, >100 dB down at ±12kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. ..... **kit $129, w/t $189**
- **R144/R220 RCVRS.** Like R100, for 2M or 220 MHz, with helical resonator in front end.....**kit $159, w/t $219**
- **R451 FM RCVR,** for 420-475 MHz. Similar to R100 above. ..... **kit $129, w/t $189**
- **R901 FM RCVR,** 902-928MHz ..... **$159, w/t $219**

TRANSMITTING AND RECEIVING CONVERTERS

Go on a ham satellite adventure! Add another band for the next contest. Thrill in the excitement of building your own gear, and save a bundle.

No need to spend thousands on new transceivers for each band!

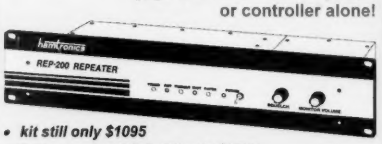
- Convert vhf and uhf signals to/from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Kits from $49, wired/tested units only $99.

- Xmitting converters (at left) for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

Get more features for your dollar with our

REP-200 REPEATER

A microprocessor-controlled repeater with full autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!



- ***kit still only $1095***
- ***factory assembled still only $1295***

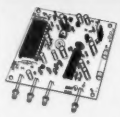
50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.) **FCC type accepted** for commercial service in 150 & 450 MHz bands.

Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** ..... only $100.

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. ..... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. ..... Kit only $695, w&t $995.

You'll KICK Yourself If You Build a Repeater Without Checking Out Our Catalog First!



Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ..... **only $49/kit, $79 w/t**

CWID. Traditional diode matrix ID'er. ..... **kit only $59**

CWID-2. Eprom-controlled ID'er. .. **only $54/kit, $79 w/t**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ..... **$59/kit, $99 w/t**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ..... **only $99/kit, $149 w/t**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. ..... **kit only $99, w/t only $149**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. ..... **$379 w/t**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. ..... **kit $89**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. ..... **kit $79**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you... **kit $49**

LOW NOISE RECEIVER PREAMPS

LNG-( ) $G_A A_S$ FET PREAMPS
STILL ONLY $59!

- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

LNW-( ) ECONOMY PREAMPS
ONLY $29 kit, $44 wired/tested

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time).
- Min. $5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, Discover, check, or UPS C.O.D.

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e-mail: jv@hamtronics.com

Our 35th Year!

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Phone 716-392-9430 (fax 9420)

RAMSEY

Synthesized FM Stereo Transmitter

Microprocessor controlled for easy freq programming using DIP switches, no drift, your signal is rock solid all the time - just like the commercial stations. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability of the FM-25; many Caribbean folks use a single FM-25 to cover the whole island! New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case set, whip antenna, 120 VAC power adapter - easy one evening assembly.

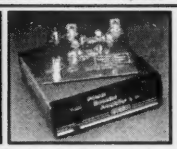
FM-25, Synthesized FM Stereo Transmitter Kit $129.95

Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Offers great value, tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer and you're on-the-air, you'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter. Add our matching case and whip antenna set for a nice finished look.

FM-10A, Tunable FM Stereo Transmitter Kit $34.95
CFM, Matching Case and Antenna Set. $14.95

RF Power Booster Amplifier



Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 KHz to over 1000 MHz! Use as a lab amp for signal generators, plus many foreign users employ the LPA-1 to boost the power of their FM Stereo transmitters, providing radio service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10 MHz, 10 dB at 1000 MHz. For a neat, professionally finished look, add the optional matching case set.

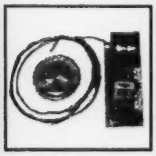
LPA-1, Power Booster Amplifier Kit $39.95
CLPA, Matching Case Set for LPA-1 Kit. $14.95
LPA-1WT, Fully Wired LPA-1 with Case $99.95

Micro FM Wireless Mike

World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps-build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to108 MHz. 7/8"w x 3/8"h x 3/4"h.

FM-5 Micro FM Wireless Mike Kit $19.95

Crystal Controlled Wireless Mike

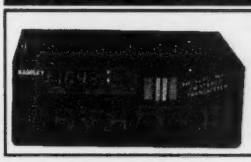


Super stable, drift free, not affected by temperature, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystals cost only five or six dollars. Sensitive electret condensor mike picks up whispers anywhere in a room and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you sneeze and loose a part!

FM-6, Crystal Controlled FM Wireless Mike Kit $39.95
FM-6WT Fully Wired FM-6 ..... $69.95

Call for our Free Catalog !

Super Pro FM Stereo Radio Transmitter



A truly professional frequency synthesized FM Stereo transmitter station in one easy to use, handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio - without over modulation, LED bargraph meters for easy setting of audio levels and a built-in mixer with mike and line level inputs. Churches, drive-ins, schools and colleges find the FM-100 to be the answer to their transmitting needs, you will too. No one offers all these features at this price! Kit includes sharp looking metal cabinet, whip antenna and 120 volt AC adapter. Also runs on 12 volts DC.

We also offer a high power export version of the FM-100 that's fully assembled with one watt of RF power, for miles of program coverage. The export version can only be shipped outside the USA, or within the US if accompanied by a signed statement that the unit will be exported.

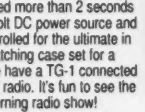
FM-100, Professional FM Stereo Transmitter Kit $299.95
FM-100WT, Fully Wired High Power FM-100. ..... $429.95

Speech Descrambler Scrambler

Decode all that gibberish! This is the popular descrambler / scrambler that you've read about in all the Scanner and Electronic magazines. The technology used is known as speech inversion which is compatible with most cordless phones and many police department systems, hook it up to scanner speaker terminals and you're in business. Easily configured for any use: mike, line level and speaker output/inputs are provided. Also communicate in total privacy over telephone or radio, full duplex operation - scramble and unscramble at the same time. Easy to build, all complex circuitry contained in new custom ASIC chip for clear, clean audio. Runs on 9 to 15VDC, RCA phono type jacks. Our matching case set adds a super nice professional look to your kit.

SS-70A, Speech Descrambler/Scrambler Kit $39.95
CSS, Custom Matching Case and Knob Set $14.95
SS-70AWT, Fully Wired SS-70A with Case $79.95
AC12-5, 12 Volt DC Wall Plug Adapter $9.95

Tone-Grabber Touch Tone Decoder / Reader



Dialed phone numbers, repeater codes, control codes, anywhere touch-tones are used, your TG-1 will decode and store any number it hears. A simple hook-up to any radio speaker or phone line is all that is required, and since the TG-1 uses a central office quality decoder and microprocessor, it will decode digits at virtually any speed! A 256 digit non-volaile memory stores numbers for 100 years - even with the power turned off, and an 8 digit LED display allows you to scroll through anywhere in memory. To make it easy to pick out numbers and codes, a dash is inserted between any group or set of numbers that were decoded more than 2 seconds apart. The TG-1 runs from any 7 to 15 volt DC power source and is both voltage regulated and crystal controlled for the ultimate in stability. For stand-alone use add our matching case set for a clean, professionally finished project. We have a TG-1 connected up here at the Ramsey factory on the FM radio. It's fun to see the phone numbers that are dialed on the morning radio show! Although the TG-1 requires less than an evening to assemble (and is fun to build, too!), we offer the TG-1 fully wired and tested in matching case for a special price.

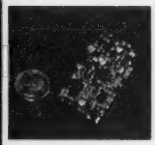
TG-1, Tone Grabber Kit $99.95
CTG, Matching Case Set for TG-1 Kit. $14.95
TG-1WT, Fully Wired Tone Grabber with Case $149.95
AC12-5, 12 Volt DC Wall Plug Adapter $9.95

Mini-Peeper Micro Video Camera

Super small, high quality fully assembled B & W CCD TV camera the size of an ice cube! Provides excellent pictures in low light (2 lux), or use our IR-1 Infra-Red light source to invisibly illuminate an entire room on a pitch black night! Imagine the possibilities... build it into a smoke detector, wall clock, lamp, book, radio. Exact same camera that's in big buck detective catalogues and stores. Kit includes: fully assembled CCD camera module, connectors, interface PC board kit with proper voltage regulation and filtering, hook-up details, even a mini microphone for sensitive sound! Two models available: Wide Angle Lens 3.6mm/f2, adjustable focus lens, 92 degree view; Pinhole Lens 5.5mm/f4.5, 60 degree view. The Pinhole Lens is physically much flatter and provides even greater depth of focus. The camera itself is 1.2" square. The Wide Angle Lens is about 1" long, Pinhole Lens about 1/2", interface PC board is 1" x 2" and uses RCA jacks for easy hook-up to VCRs, TVs or cable runs. Power required is 9 to 14 VDC @ 150 mA. Resolution: 380 x 350 lines. Instruction manual contains ideas on mounting and disguising the Mini-Peeper along with info on adding one of our TV Transmitter kits (such as the MTV-7 unit below) for wireless transmission!

MP-1, Wide Angle Lens CCD TV Camera Outfit $169.95
MP-1PH, Pin-Hole Lens CCD TV Camera Outfit $189.95

MicroStation Synthesized UHF TV Transmitter



Now you can be in the same league as James Bond. This transmitter is so small that it can fit into a pack of cigarettes - even including a CCD TV camera and battery! Model airplane enthusiasts put the MTV-7A into airplanes for a dynamite view from the cockpit, and the MTV-7A is the transmitter of choice for balloon launches. Transmitter features synthesized, crystal controlled operation for drift-free transmission of both audio and video on your choice of frequencies: Standard UHF TV Channel 52 (which should only be used outside of the USA to avoid violating FCC rules), and 439.25 MHz or 911.25 MHz which are in the amateur ham bands. The 439.25 MHz unit has the nifty advantage of being able to be received on a regular 'cable-ready' TV set tuned to Cable channel 68, or use our ATV-74 converter and receive it on regular TV channel 3. The 911.25 MHz unit is suited for applications where reception on a regular TV is not desired, an ATV-79 must be used for operation. The MTV-7A's output power is almost 100 mW, so transmitting range is pretty much 'line-of-sight' which can mean many miles! The MTV-7A accepts standard black and white or color video and has its own, on-board, sensitive electret micorphone. The MTV-7A is available in kit form or fully wired and tested. Since the latest in SMT (Surface Mount Technology) is used to provide for the smallest possible size, the kit version is recommended for experienced builders only. Runs on 12 VDC @ 150 mA and includes a regulated power source for a CCD camera.

MTV-7A, UHF TV Channel 52 Transmitter Kit $159.95
MTV-7AWT, Fully Wired Channel 52 Transmitter $249.95
MTV-7A4, 439.25 MHz TV Transmitter Kit $159.95
MTV-7A4WT, Fully Wired 439.25 MHz Transmitter $249.95
MTV-7A9, 911.25 MHz TV Transmitter Kit $179.95
MTV-7A9WT, Fully Wired 911.25 MHz Transmitter $269.95
ATV-74, 439.25 MHz Converter Kit $159.95
ATV-74WT, Fully Wired 439.25 MHz Converter $249.95
ATV-79, 911.25 MHz Converter Kit $179.95
ATV-79WT, Fully Wired 911.25 MHz Converter $269.95

RAMSEY ELECTRONICS, INC.
793 Canning Parkway
Victor, NY 14564

Order Toll-free: 1-800-446-2295
Sorry, no tech info or order status at this number

Technical Info, Order Status
Call Factory direct: (716) 924-4560

VISA MasterCard DISCOVER

ORDERING INFO: Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $4.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no CODs. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

ASTRON CORPORATION
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SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0

SS-25M With volt & amp meters
SS-30M With volt & amp meters

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

• LOW PROFILE POWER SUPPLY

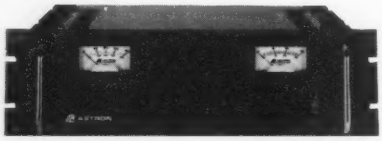
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

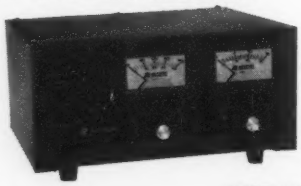
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES

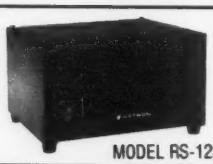


MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES



MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

73 Amateur Radio Today

Including Ham Radio Fun!

JULY 1997
ISSUE #442

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On the cover: Al Wright of Huntsville, Alabama, prepares HALO ATV rocket for maiden voyage to 30,000 feet. Photo by Bill Brown WB8ELK. See "Rocket Video" (page 35) and "ATV" (page 50) for high altitude adventure. Need some cash for that new rig? Send us your possible cover shot photos, gladly returned if not purchased.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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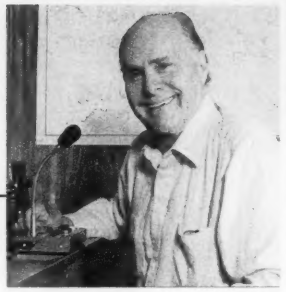
NEVER SAY DIE

Wayne Green W2NSD/1



What More Can I Say About Hamfests?

A note from Walt Bastow N4KVF suggested I comment on the disintegration of our major hamfests. Okay.

When around 90% of the local hams don't bother to go to a hamfest or convention it should be taken as a sign by the organizing committee that maybe the event isn't perceived as worth the time and price. Not enough fun. Bo-o-oring.

As I've pointed out before, I went to my first hamfest in 1938 and though the world has changed beyond belief, hamfests haven't. As with the code, amateur radio seems firmly mired in its past—anchored there by the ARRL and its CW-fixated board. Take a look at a 1937 issue of *QST* and tell me what differences you find in 1997, sixty years later. Small cosmetic changes have been made, and that's about it. About 70% of the magazine is still advertising and club news.

If hamfests are going to survive they need to be re-invented. With attendance dropping fast, it's getting harder to attract exhibitors. The main things a hamfest has to offer are the commercial ham exhibits, the flea market, and speakers. How many hamfests have you bothered to attend in the last couple of years? If any one of them had an exciting speaker, please drop me a QSL card with his name. In my experience there's a good reason why the talks at hamfests draw so few listeners—they're dull. I've sampled many of them, just to see for myself.

I've already written about my ideas for making hamfests into 1990s entertainment, but I've seen no sign that anything has changed.

With around 60% of today's hams feeling disenfranchised by the League because they are Novices or Techs, they're not big on joining ham caravans driving to the big hamfests. Their ham friends are all in their local repeater area, not spread around the country. And they are not enough into ham satellites and other ham special interests to want to spend the time and money to get together with similarly-interested hams from outside their area.

I've never seen any hint in the many club newsletters I get, nor any word from a reader, suggesting that any hamfest committees have done any opinion surveys to find out what hams like and don't like about hamfests. So I'll do one right now.

If you've been to a hamfest in the last couple of years, what part of it was the most fun for you? What might the hamfest committee do that would make it more fun? Have you passed up going to any hamfests, and if so why? Can hamfests be salvaged or has their day passed?

A few years ago *CQ* Magazine announced they were launching a series of commercially run hamfests. Far's I know the series ended with the first gigantic flop.

One of the problems, I suspect, has to do with money. Hamfests can be very profitable for the organizers, with one group reputedly skimming hundreds of thousands of tax-free dollars. This has tended to continually increase both the attendance price and the cost of booths for exhibitors, while keeping promotional and other expenses to a minimum. With so much money floating around and so little accountability, there's bound to be mischief. And since most hamfests are chaired by a ham with little experience in running big events or in dealing with large amounts of cash, it's no wonder we hams have, in the long run, been shortchanged.

I'd like to see hamfests used more as promotional events to get kids interested in the hobby, with major promotions to bring the kids in and entertain/educate them. How about a ham in a balloon with an HT talking with kids on the ground, complete with a ham video camera showing the guy in the balloon talking?

How about a slow-scan TV demo with someone in Africa or Europe on schedule, letting the kids talk to the chap they're looking at? Now you think up some stunts which will get the kids excited.

Folks, it's grow or go. Your choice, but please don't look around for any leaders to follow. We haven't any.

NASA Confirms Cold Fusion Excess Heat!

Using a nickel-potassium carbonate (light water!) cell NASA scientists confirmed and reconfirmed the cold fusion excess heat phenomenon. Using different current levels and one pulsed current test their power gains ranged from 1.06 to 1.68. The tests were run by the NASA Lewis Research Center Group in Cleveland, Ohio using a cell borrowed from Hydrocatalysis Power Corporation.

The cell had previously been producing "Fifty watts of steady excess heat for a continuous period exceeding hundreds of days."

The report concludes, "Considering the large magnitude of benefit if this effect is found to be a genuine new energy source, a more thorough investigation of evolved heat in the nickel-hydrogen system in both electrolytic and gaseous loading cells remains warranted."

The report covers the history of the Pons-Fleischmann announcement and the quickly-following negative reports from Harwell, CalTech and MIT—which, interestingly enough, easily found publication in scientific journals, while positive reports were denied publication.

The report points out that modern cells of various types "have power multiplication factors over 10, and have achieved powers as high as ~4kW/cm^3. If true, such data clearly exclude by orders of magnitude an ordinary chemistry explanation and force one to consider various lattice-assisted nuclear channels."

NASA's obvious interest is as a "power source to replace radio isotope thermal generators for planetary spacecraft."

Considering, from what we know now, that the cell used 0.5 mm nickel wire for the cathode, we can understand the delays in loading hydrogen into the nickel lattice, and the relatively low power gains achieved. Patterson and his CETI group have been reporting gains in the 1,000 and up range using powdered and thin-films of nickel.

You can get your very own copy of this NASA report by asking for N96-22559. My Congressman, Charlie Bass, got one for me.

Will word of this NASA report ever reach the Department of Energy?

Nut Nut Nut Nut Case

I plead guilty to being a nut. I'm a radio nut, a car nut, a camera nut, a health nut, a UFO nut, a ski nut, a scuba nut, a gourmet nut, and so on. Oh yes, a computer nut too. And a classical music nut and cold fusion nut. I'm so nutty I practically rattle when I jog.

Now, with my health nut beanie in place, propeller spinning, driven almost to levitation speed by the force of my emanating brain waves, let's talk about the bioelectrifier. Yes, it's a great little gadget, and ridiculously simple to build and use. But it does tend to cater to the need for people's immediate gratification.

The more I read about health, the more the pieces all fit together—and the picture is a mess. Let me explain.

If you want to have a healthy body you need to provide it with the raw materials your body used as it developed over the course of a million years or so. The main reason we're sick and dying 20-30 years before we need to is our not providing our bodies with the building materials they were developed to use.

Like what? Heck, we've got one of the best food supplies in the world, right?

Umm, not quite. Yes, I've written about some of this before, but you need a refresher.

Your body needs air, water, sunlight, the foods it was designed to use, exercise, and a relative freedom from stress. It also needs a freedom from poisons.

Take water, for instance. Just look at the stuff you've been drinking! It's got added fluorides, chlorine, dioxin, lead, copper, and stuff like that. Are you drinking distilled water yet? Are you drinking at least eight glasses of distilled water every day? That's what the body uses to help flush out the poisons which would otherwise accumulate. There are four excellent books on water in my guide to books you're crazy if you don't read.

Sunlight. Sure, too much can be damaging, but for 99% of us (or more) it's too little. We keep those "harmful" UV rays out of our eyes with glasses, windows, and so on. If you'll read a couple of books on light by Ott and Lieberman you'll be out there with your glasses off getting UVs into your eyeballs on your morning walks. Our eyes and skin need sunlight. In moderation.

The worst is our food supply. Hey, don't believe me about this, put me down as a nut. But at least do me the courtesy of doing your homework. Dr. Joel Wallach and his "Dead Doctors Don't Lie" tape may have some exaggerations, but he's right about the vitamins and minerals being long gone from our supermarket foods. You either take supplements or you get sick and die. Usually painfully. Read his *Let's Play Doctor* book—also his *Rare Earths*, which I'll have to add to my reading guide. Do your homework and then tell me I'm a nut.

You must have read about all the crud they're putting in our meat supply. Antibiotics, hormones, and so on. That just makes those Whoppers and Big Macs all the more deadly. And the movie theater popcorn popped in artery-clogging goo.

Poisons? Like alcohol, nicotine, aspartame, mercury, fluorides, caffeine, immunization shots.

Two of my favorite TV programs are "The Simpsons" and "Roseanne." Both feature big fat constipated-gut beer-drinking fathers. I enjoy the programs for the writing, though Roseanne's show has gone downhill substantially since losing Dave Raether as an associate producer. Both fathers spend most of their time drinking beer and watching ball games on TV. What a terrible way to waste one's life. Instead of learning and contributing to the world, they sit staring dumbly and poisoning their bodies. Great role models.

Our ancestors spent a lot of time out in the sun, got lots of exercise, and ate mostly raw fruits and vegetables grown in mineral-rich soil. No poison sprays.

By the way, if you'll read *Secrets of the Soil*, you learn that insects only attack sick crops. If you give the crops the minerals they need instead of chemical fertilizers the bugs won't bother them.

Far's I know they don't teach any of this stuff in school. Not even college. So how can a person find out about how bad our water and food supplies are and what to do to live a healthy life?

How many really healthy people do you know? My mother fed me pretty well when I was a kid, so I had such outstanding teeth that dentists would call in their assistants to look at them when I had my checkups. It wasn't until after I went away to college and then joined the Navy that I had to have my first filling. It wasn't until my sophomore year in high school that I even tasted soda pop or a Coke. White bread and sugar? Cold cereals? No way! I still love all hot cereals, and without any sweetening.

Once you start doing your homework I'll bet you'll get excited over thinking and start making a similar nuisance out of yourself trying to get others to turn off the TV and start reading. The mind is like a muscle; the more you use it the stronger it gets.

So let's start with stuff that has an immediate application in making you healthier. If you give your body a break you're not going to need a bioelectrifier to get rid of viruses, microbes, parasites, yeasts, and fungi in your blood because your immune system won't permit them to set up shop in the first place. Our bodies come with a fantastic error detection and repair system. Given an even break your maintenance system will keep you stroke, cancer, and Alzheimer's free for life. You can go visit your old friends in their nursing homes, and then visit their children in the same homes a generation later.

Now, isn't it about time to start repairing the damage you've done to your body? You've got a truly amazing repair system built in—one that can keep you alive despite all the poisons and poor nutrition you've insulted it with. Just give it a real chance to do its work.

If my lecturing is annoying, shrug it off. But what I wish you'd do is make a list of your chronic illnesses and then seriously change your pattern of living and keep track of the gradual elimination of fat, arthritis, and so on. And let me know that I've helped. I can live with the cat calls and ridicule from the nonthinkers if I'm able to reach a few readers and help them have happier lives.

Stress? Yep, that's a big factor too. Indeed, every illness has a psychological component, so maybe it's time to start solving your stress problems.

End of lecture. For now.

Quid Pro Quo

That's Latin for getting something for something. Like what does the public get from us in return for our allocation of billions of dollars in frequencies?

A 13-page special invitation to join the AARA as an alternative to the ARRL almost got me to thinking. Now, if the American Amateur Radio Association were a legitimate (in my eyes) group, at this critical time in our history I'd say that it would be folly to get involved in a civil war.

So, am I saying, "In union there is strength," join the ARRL? The strength of a union is only there when the union members have some say in the running of their union, and from everything I've seen, the average ARRL member hasn't even a nano-voice in the ARRL. The ARRL Board will listen to you up until they get your membership check. When you send in your membership you are paying for some hoped-for future service (like the survival of the hobby). When you refuse to pay up until you see some significant signs that you are going to get the service you want, that puts pressure on the tight-knit old-boy group running the League to actually do something. They'll do a lot to get your money, but little once they have it. That's just plain old human nature at work.

The AARA, a.k.a. Glen Baxter K1MAN, looks to me like a new pyramid scheme with Section Managers getting a 10% piece of the action for every new recruit and State Directors getting 5%. Membership seems to be $35 a year. Then there's the American Amateur Radio Council (AARC), where membership costs $250 a year. That's a division of the AARA. Then there's the Amateur Radio Management Consultants (ARMC), the Foundation for the Advancement of Amateur Radio (FAAR), the Domestic Amateur Radio Emergency organization (DARE), the *American Amateur Radio Digest* (*AARD*), a monthly newsletter, the International Amateur Radio Network (IARN), the Amateur Radio Peace Corps Foundation (ARPCF), the American Amateur Radio School (AARS). And so it goes. It looks to me as if Glen has built a "Potemkin Village" one-man organization in order to take advantage of the present weakness of the ARRL.

The League's stand on the code has made it seem irrelevant to about 60% of the licensed hams. Talk about a death-wish!

Worse, from what Glen Baxter is saying, he's blaming the ARRL for the influx of no-code hams and promises his AARA will push for "higher quality hams." He calls the ARRL "corrupt, petty, irrelevant, and overly commercial," with a "Neanderthal Mental Midget Mentality." He seems to be concentrating entirely on his pyramid of Section Managers to solicit membership from already licensed hams rather than pushing them to get kids involved to build up our numbers. No mention of that.

I've found Glen to be a dedicated man—overwhelmingly dedicated to promoting Glen.

We don't need a civil war in hamdom right now—what we

Continued on page 26

LETTERS

From the Ham Shack

Bill Mayers, Canastota NY. In the May issue of *73*, you said you had never received a negative report on the "Bioenergizer." I sent you such a report, and you ignored it. Shortly after it was first described in your magazine, I built one and began using it. I told you that within six months, I developed irritable bowel syndrome and diabetes, and began experiencing migraines. You did not respond. You have a habit of taking the "medical establishment" to task for failing to own up to the fact that some of their products can be hazardous. Wayne, to fail to tell your readers that I have found this device to be dangerous (diabetes is a deadly disease), you are being even more dishonest, by pretending to be a guardian of your readers' well-being, yet pushing a useless and dangerous product. Show us there is a difference between Wayne Green and the crack-dealing creeps who lurk around our children's schoolyards. Print a retraction.

By golly, you are right and I was wrong. I should have said that I hadn't received any credible negative reports. Diabetes, eh? Normally that takes several years of misuse of one's body to develop. And migraines normally stem from the same cause as irritable bowel syndrome. You have not been doing your homework and I have. Both the Coca and Wallach books, which are recommended in my guide to books you're crazy if you don't read, cover these two allergy problems. These symptoms have nothing to do with any virus, microbe, parasite, fungus or yeast in the blood. By the way, Wallach covers the cause and a simple cure for diabetes in his book. I've already written about why crack dealers are making so much money. We can thank the government for that beaut. Based on the Albert Einstein College of Medicine discovery and patent, plus the reports from Bob Beck and quite a few readers, the bioelectrifier makes good scientific sense to me. I can see where, after extended use, one would want to replace any lost beneficial microbes via acidophilus milk. I am anxious to hear about any positive or negative effects. Is this going to turn out to be the medical industry's worst nightmare, or just another placebo exciter?... Wayne.

Michael Borer WL7CKB, Anchorage AK. Re the AC5HU comments on the ARRL "code survey," I am sure glad to find someone else that was not taken in by the "Anti-Revisionism Radio Louts" either. The ARRL sends out an opinion poll on whether or not to keep the ANTIQUATED CW requirement for HF licensing and what do they do? They "Sing to the Choir" of the already converted. Now I, for one, am definitely not in favor of the elimination of CW from our bands, but since all the ITU requires is a "knowledge of code" to qualify for the HF bands, and since even the FCC, in their "Notice to Physician," on the back of the Form 610, states that a 5 wpm proficiency is all that is required for our physically challenged hams, why should the rest of us be forced to meet the overinflated, arbitrary and capricious code speeds?

While the ARRL continues to discriminate against the vast majority of licensed amateurs, there is one group, the "Code 5" group, headed by Guy Matzinger KB7PNQ, 503 Dubois St., Cheney WA 99004-1325, fighting to have the code requirement reduced to a sane 5wpm speed. All interested, licensed hams should contact Mr. Matzinger and sign the petition that he is circulating and even help financially, if at all possible, so that he can go before the FCC with a big stack of ham signatures in favor of a change in licensing policy.

Now, I know that there are those out there that will scream that we are trying to lower the standards for receiving a ham license, but nothing could be farther from the truth. Since this is a technical hobby, not a physical training hobby, I would propose a toughening of the technical aspects of the exam, not perhaps to the point of having to draw and build a circuit, but definitely having to learn about antennas, packet and all the various modes of communication. If we want to push the technological envelope again, as we once did, it is definitely time to quit wasting our precious time with a physical training exercise, and learning a mode of communication that virtually all other entities, both private and government, have discontinued using.

Good grief, another troublemaker! ...Wayne.

Lionel C. Allen VK6LA, South Como WA. Here's a bit of midnight reading for you. Your April *73* mentioned dowsing. Here's an experience I had years ago. Dowsing with an odd twist. I was on Air Force leave and visited a very respected and quite elderly neighbor right across the road from where my family lived. He had taught my brother, some 12 years older than myself, a lot about black and white photography, as he did with me years later. On this visit the general talk turned to dowsing. Not just the simple finding-water stories, but also health diagnosis by utilising various minerals held in his hand and short-length pendulums. I seem to remember being diagnosed as having a shortage of some mineral or other. Quite frankly, I didn't believe the stories he told, but on the other hand, this gent just did not tell lies. Additionally, he had all his experiments carefully written in a small notebook.

Then we went outside to carry on some traditional water dowsing. My elderly neighbor was absolutely certain he could teach me the basic art of finding not only fresh water, but trails of impure water created by sewerage contained in underground plumbing. If the neighbors thought it a bit weird as a 19-year-old and an 80-year-old wandered up and down the yard hand in hand, they didn't comment. For my part, though, not a single twitch was generated from pieces of wire, various twigs, and so on.

Some time later I was posted to a fairly remote location at an Air Force transmitter station in Northern Australia. With only six staff in all, and as it was an easy-going job, I took to walking some of the trails well marked by, and used by, Australian aboriginals. Purely by chance, I one day broke off a small branch of a tree and soon had a traditional dowser's forked branch held out in front of me. To my astonishment, the dowsing fork gave a very strong reaction in two separate locations not far from where the camp was set up. I traversed the area for a good hour, but only those two exact locations gave any response over a good half mile or so. I went back to our small mess and spread the word!

Naturally, there were the usual nudge-nudge, wink-wink remarks, but enough enthusiasm was aroused for others to try their skill. I explained the general idea and got four of the other fellers lined up at a good distance apart and headed them off down the track I had just walked. I declined to tell them where the actual dowsing reaction had occurred. Also, I asked them not to indicate to each other if and where they might receive any dowsing response. Again, and you've guessed correctly, in the exact same locations four out of the five of us got reactions. The general dowsing enthusiasm lasted long enough to convince several of us there really was something in this business after all.

However, the story isn't quite complete. As enthusiast number one I dowsed the whole damned area without any other really good responses! That is, until one day I began to realize that every time I headed out around the camp and under every overhead feeder line from the transmitter station, I got a strong response. Obviously, from the overhead lines. For some reason, I was the only one of the six to get these reactions. Now, the feeders from the reasonably large number of antenna systems covered a lot of territory. As others didn't get the same reaction, it was either provide further proof or call the men with the little white coat.

So, well and truly blindfolded, I was guided around the general area and periodically under the

open wire overhead feeders. Well, blindfolded or not, I was infallible! So how about that for a twist, Wayne? I hope one of your books doesn't have a method of making a million out of overhead feeder line dowsing because I never ever found any use for it. At least I was converted from a nonbeliever to a firm believer and had a fair bit of fun in the process.

Hey, I wonder if it stemmed from the group I played with as a youngster—we were the greatest kite flying enthusiasts for miles around. With plenty of open space around in those days, a dozen or so of us would take off with kites up high and well out in front of us in the afternoon sea breeze. All power reticulation was overhead, but we would take off in line and walk slowly for I'd say about a mile. At each block the older kids would run out some extra string and then hurl the ball over the top of the power lines! I never once recall seeing a ball caught up in the power lines but I guess it happened. At the end of the walk we'd reel in the kites and walk back home.

I've never ever since seen kids repeat that sort of kite flying. Maybe I was lucky. Perhaps I was lucky to spend a lot of time living with my aunt and uncle on a wheat and sheep farm. Many times we would harness two or more large kites together and launch one of the farm dogs up for a ride up in a bag harness. We never ever had a complaint from the dogs and they apparently didn't mind too much either, as they would always join us from day to day. Not that I recall ever getting one up much higher than twenty feet or so. I'd reckon not too many kids did that either!

Gosh, and I was going to tell you how I've been trying to whip up a bit of enthusiasm in amateur radio. Never mind, I'll write again. Now you can go back to sleep!

Zzzzzzzz. Lionel, this is a ham magazine and you're supposed to write about ham radio, not dowsing and kites. Got that? On dowsing, any nudge-nudgers should not read the Owen Lehto book, Vibrations, *which is ... of course ... in my reading guide ... Wayne.*

Jan Medley KBØWQT. *73* has a well deserved reputation for "pot stirring" and I usually regard that as a big plus. But sometimes a columnist goes right off the rails and needs a reality check. Such was the case with Joseph Carr's column in your May issue. "There is no excuse for offering MS-DOS software any longer," says Mr. Carr. He's entitled to his opinion, but he should know better than to make such categorical, unsupported statements with complete disregard for the facts. As a long-time personal computer user of both Windows and DOS software, I found the column insulting, misleading, and generally worthless—even if one ignores the question of what a column on software design might be doing in a ham radio magazine. Here are some facts:

1. First and foremost, Windows 95 (and its predecessors) is ... wait for it ... a DOS program. It is a GUI and a number of utilities for memory management and hardware management including multi-tasking, but if you look under the hood you will find that DOS is still there as the Disk Operating System. For whatever reasons, Microsoft may have fooled a lot of people by changing file names and "kernelizing" DOS, but you have to look to NT in order to find a version of Windows that is actually an operating system in its own right. This is a lost battle, I know, and the end result is that most users will think Windows is an OS, but the point is that anything that can be written for DOS can run "under" Windows, and any Windows program is ipso facto a DOS program as well.

2. Not everyone can afford the hardware necessary to support a Windows 95 installation. Starting price is close to $2,000, while DOS machines are commonly

Continued on page 55

QRX . . .

New "Ark" for WB6NOA

After 20 years of faithful emergency communications service, the Gordon West WB6NOA black station wagon will retire and "NOA's ARC," a new Amateur Radio Communications vehicle, will take over. Gordo indicates the new ARC unit will be used for classroom demonstrations as well as VHF/UHF/microwave DXpeditions.

"This new unit will be added to our water-grid arsenal, now allowing us the capabilities of attending regional ham shows, and having all of our microwave equipment onboard," he said. "It will also serve as an emergency communications vehicle for our local American Red Cross chapter, plus emergency communications for the city of Costa Mesa."

West's new communications vehicle is built around a Chevrolet 22-foot G30, a 1-ton extended van chassis with a 7.4 liter 454 CID EFI V8 gas engine. There will be a 4.5kW generator installed beneath the rear radio operating area to provide plenty of power for all the amateur radio equipment onboard.

The upper portion of the vehicle, built by Home & Park Motorhomes in Ontario, Canada, is called "Roadtrek." The roof is Fiberglas™, but contains built-in copper screening for good RF shielding between the antennas and the passenger compartment.

"All of the antennas will feature lip-mount and gutter-mount technology from the leading antenna manufacturers like Diamond and Comet. We will also have a motorized antenna lay-down mount from Maldol," West continued.

His idea of "no holes" was to specifically test the new generation of antenna mounts that secure firmly to almost any ridge, lip, or metal edge. "We will even run a full-length, high-frequency whip off of the rear door tire mount, and again, we will go only with off-the-shelf antenna mounts available at all ham radio stores," he added.

Built into the screen area separating the metal sides of the vehicle and the Fiberglas roof will be an automatic high-frequency antenna coupler with a long-wire attachment. "This could allow us to string up a long wire, using the screen as well as the chassis sides of the vehicle for a great ground plane system," he said. "We will also be able to put a strong signal on 75m, the coordination band for weak-signal tropo and meteor scatter work."

Long-boom yagi antennas will be carried on the inside of the vehicle. The booms would be separated so as not to exceed the length of the vehicle. The yagis would operate either fixed-direction or, for now, via the "Armstrong" rotor system.

When it comes to the ham radio equipment on the inside, West claims that each and every manufacturer of amateur radio equipment will be represented.

"We will have 160m through 10,000MHz ... and this will allow students to enjoy hands-on exposure to every brand sold through dealers or direct, and this way our mobile classroom will support everyone in the industry equally," adds West.

Plans also call for large magnetic signs, indicating AMATEUR RADIO ON THE AIR, so that the vehicle may also travel as an amateur radio information center. "We plan to make this unit very visible during amateur radio operating events like Field Day and Simulated Emergency Tests. We will also carry amateur radio information packages, including amateur radio magazines, ARRL information sheets, and ham publications, along with manufacturer frequency charts and *Welcome to Ham Radio* guides," West sums up.

There will be three operating positions inside the vehicle: the front for high-frequency; midsection for VHF and UHF; and the rear area that will carry satellite and data equipment.

"I look forward to working many stations on the air from NOA's ARC," smiles West. Plans call for a West Coast "shakedown," and then looking into other engagements throughout the rest of the country. Gordon West's wife, Suzy West N6GLF, looks forward to driving while "Gordo" scurries around inside, keeping everything on the air "ARC Mobile."

ARRL Calls on FCC to Privatize Handling of Malicious Interference Complaints

Citing "a substantial need to improve and increase the quantity and quality" and timeliness of enforcement in malicious interference complaints, the ARRL has called on the FCC to "create a streamlined, privatized enforcement process" to handle and adjudicate the most serious Amateur Service rules violations. In a petition for rulemaking filed March 28, the League asked that the FCC change its rules to permit members of the volunteer Amateur Auxiliary to bring evidence of malicious interference violations directly before the Chief Administrative Law Judge. The chief ALJ would be authorized to determine if the complainants have a valid case, to issue show-cause orders, and to designate complaints for hearing.

The League recommended that the FCC capitalize on the volunteer resources available through the Amateur Auxiliary to relieve the evidence-gathering burden in such cases. If the rules' changes are approved, the League said it would likely assist members of the Amateur Auxiliary in preparing and submitting complaints and in presenting cases at administrative hearings. "The increased use of volunteer resources would seem to be entirely appropriate in the Amateur Service, which involves avocational use of radio only," the ARRL concluded.

While noting that most hams obey the rules, the League said Amateur Radio needs the commission's help "in a very few, persistent, serious enforcement cases" but has not been getting it in recent years because of the FCC's staff and budgetary limitations.

"Indeed, notwithstanding the best efforts of the Commission over the past several years, there has been no resolution of the four or five most serious cases brought to the Commission's attention," the League said in its petition. Even in some of the cases the FCC did act upon, the League said the Commission did not go far enough to make the problems go away permanently. The League cited a case in New Orleans where fines against several amateurs were reduced but remain unpaid and uncollected. "There is a widespread, and growing, perception that administrative forfeitures are not collectable," the ARRL said, pointing to the complex, time-consuming method of collecting fines that is required by federal law. The ARRL noted that while the FCC suspended one ham's license in that city in 1996, it failed to look into malicious interference charges against at least two other hams in that area. The League said examples like these send a message that the FCC won't enforce Amateur Service rules in malicious interference cases. Informal mediation attempts also have failed. "Malicious interference problems, if left unchecked, tend to spread and increase in intensity," the League said. The ARRL suggested that a series of "visible, successful enforcement actions" would deter rules violations and promote self-regulation.

The ARRL also suggested that some FCC policies get in the way of timely, effective enforcement. Current Wireless Telecommunications Bureau policy requires the Commission to independently

corroborate evidence gathered by Amateur Radio volunteers. "The policy often acts as an absolute obst[illegible] to any enforcement activity whatsoever" and demoralizes volunteers, who view their efforts as wasted.

While noting that malicious interference cases often attract a lot of attention within the amateur community, the League said ham radio can be "justifiably proud" of its history of voluntary rule compliance. "The overall level of compliant behavior among amateurs has not deteriorated over the years," the League emphasized, citing fewer than 10 active malicious interference cases in the US at present.

TNX *Tuned Circuit*, monthly bulletin of the L'Anse Creuse (MI) ARC, May 1997, from the ARRL letter.

Lights! Camera! Action!

Some ham radio paraphernalia supplied by the ARRL will appear in the upcoming Warner Brothers™ film, *Contact*. The League loaned the movie makers vintage *QST*s and other publications and maps for use in the production. Mike Gastaldo of WB's props department said the radio shack scenes "happen in the first 15 minutes of the film. You can tell people to go for the ham radio scenes and stay for the astrophysics."

Gastaldo expressed thanks to the League for "helping us to portray Amateur Radio in as realistic and positive a way as possible." The movie is scheduled to open July 11.—ARRL.

From the *Tuned Circuit*, monthly bulletin of the L'Anse Creuse ARC (MI), April 1997.

Phase 3-D Launch Delayed Until September, 1997

Paris, France (AMSAT News Service)—In a formal announcement from Paris on March 24th, the European Space Agency (ESA) said that the second test flight of their new Ariane 5 booster has now been rescheduled from July to mid-September, 1997. It is this flight, Ariane 502, on which Phase 3-D is currently manifested.

According to their latest announcement, this action was being taken by ESA and CNES (the French Space Agency which manages the Ariane 5 program for ESA) in order to "improve (the booster's) robustness, increase the operational margins and allow for degraded operating modes."

In a joint statement a day after the ESA announcement, Phase 3-D Project Leader and AMSAT-DL President, Dr. Karl Meinzer DJ4ZC, along with AMSAT-NA president Bill Tynan W3XO, expressed continuing confidence that ESA and CNES will succeed in completing all the tasks necessary for a successful flight test of Ariane 502.

"Naturally, we were disappointed that our launch will not be as soon as we had hoped," said Meinzer. "However, I am pleased that ESA and CNES are taking care to improve the operational margins for the Ariane 5 booster. This action helps give us renewed confidence in the overall probability for a successful launch of our satellite."

Both Meinzer and Tynan emphasized, however, that this launch delay, like the earlier ones, means that the total cost of the Phase 3-D Project will increase significantly. Even before the latest ESA announcement, AMSAT-DL and AMSAT-NA were projecting a combined budget shortfall of about two hundred thousand dollars (US) in the money needed to complete their respective tasks on the project.

"This shortfall can only increase now as a result of this latest schedule change," said Tynan. Both AMSAT leaders urged everyone to continue doing as much as they possibly can to ensure the needed funds will be in place for the completion and launch of Phase 3-D.

From AMSAT news release, March 19, 1997.

CQC Top Ten Signs You've Been a Ham Too Long

10. You refer to the kids as "harmonics."

9. Every time you make a mortgage payment you think about what sort of rig you could buy for the same money.

8. Towers, yagis, and odd bits of wire in the air look "pretty."

7. Your car license plate has your callsign on it.

6. You use Q-signals in everyday speech.

5. Your first consideration in looking for a new home is where the antennas will go.

4. Your mobile rig is worth more than your car.

3. You refer to your kid's boom-box as a "rig."

2. You have jockey shorts with your callsign embroidered on them.

And the number one sign You've Been a Ham Too Long:

1. Two words: "dit dit." [*Ed. Note: A CQC inside joke—it's the trademark signoff of QRP guru K5FO.*]

From *Low Down*, official journal of the Colorado QRP Club (cqc@aol.com).

Repeaters: How They All Came About

Once upon a time, there lived a scattered group of persons who wanted desperately to talk with other persons who lived in the far away berry patches.

After much deliberation, they selected one of their clansmen who just happened to live atop a big hill and who had a big mouth—and excellent hearing. The one in the valley yelled remarks to the top of the hill, where the top man then repeated what he heard so that all listeners, everywhere, would know what was being said from here and there.

Now it happened that some individuals could not hear the voice from atop the hill in good fashion. Also, some of the traveling salesmen riding their donkeys in some distant valley remained unanswered because their voices fell upon empty air.

There were some souls in some geographical spots that had been taught to whistle just right before they yelled to the re-sayer. Unless he recognized a certain whistle, he refused to do any hollering for them.

All in all, it was a happy experience for most folks. In fact, it was suggested that the idea be put upon a stone tablet and preserved for posterity. It was done.

Author unknown; the *ARNS Bulletin*, April 1997, got this from the *SERA Repeater Journal*, December 1996.

What To Do About the Code

Amateurs are fascinated with coded transmissions. We bitch, moan and complain endlessly about the CW testing requirements forced on the Amateur community and then insist on using every CW "Q-code" known to man while working the local clear channel repeater.

I guess, to prove that you are a "real" ham, you must use as much "Radio Speak" as possible, but it does take a little bit of practice to become really proficient.

I just heard an OM on 2 meters going to QRX (he didn't say when). Often we will QSY to "you know, that other frequency" for private QSOs and, when we go home to the QTH after work the XYL will often force us to QRT at dinner time.

How often have you been QRM'd recently? Not to mention the constant problems with QSB and the fight with QRN in the summer. I never know when I am going to be QRX'd and I am never really sure of my QRY on the net. I never know the QTR (probably because I have two watches) and no one ever agrees with my QTB.

I hate guys (and gals) that QSK me and then are unable to QSL because they have not been QRV when I CQ.

The FCC encourages the use of phonetics as formulated by the ITU when encountering QRM or when signals are QRJ. The object of which is, of course to facilitate communications and avoid mistakes. This can be real fun depending on who is on the other end of the QSO. Since most of us don't bother to learn the current version of the phonetic alphabet (at least not all of it) the simple A-B-C-D can become:

Able, Baker, Charlie, Dog or... America, Bolivia, Canada, Denmark or... Alpha Bravo, Charlie, Delta... all of which, depending on your age, are, or at least were, acceptable phonetics.

Then there are those who must invent their own phonetics. When this occurs, N2VPN can become: Noah's-Two-Very-Peculiar-Nomads.

By John Buzby N2VPN in *Harmonics*, South Jersey Repeater Association, April 1997.

The Bones of the Organization

1. The *wishbones:* those who wish somebody (else) would do something.

2. The *jawbones:* those who talk about the problem, but do little else.

3. The *knucklebones:* those who knock everything—especially the backbones.

4. The *backbones:* those who carry the load, but usually don't say much.

What type of Bone are you?

Think about it!

TNX *ARNS Bulletin*, April 1997; *Collector and Emitter*, November 1996; *Counterpoise*, November 1994. 73

ATV is Here to Stay!

Getting started with amateur television.

Andrew C. MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083-5640

Amateur television, or just ATV, can refer to fast-scan TV that we see at home on the "tube," slow-scan TV that periodically produces a new still picture (depending on the format), or something in between. The transmission of images as digital files, via terrestrial or satellite links, can also be considered amateur television. But the real fun comes back to the *first* definition. Full-color, full-motion, fast-scan TV is gaining popularity and acceptance in the amateur community.

My first ATV experience dates to a period when HF transceivers had more tubes than transistors, VHF-FM was new to most hams, and to change frequency up there, you had to buy new crystals for the desired channel. Amateur television enthusiasts operated on UHF frequencies, above most "normal" ham activity. They had equipment that most hams couldn't recognize, understand, or afford. The ATVers of that day were either electronics design engineers, or worked in the TV broadcast business, or both.

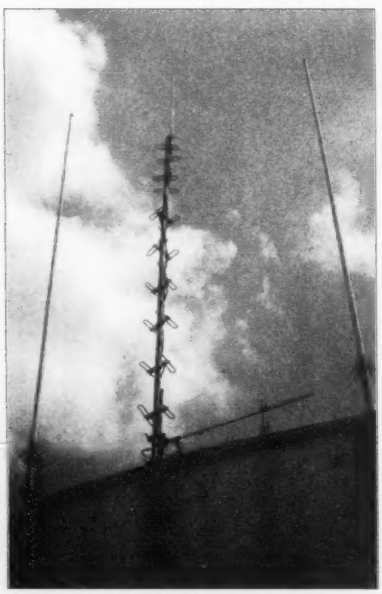


***Photo A.** HATS ATV transmitter site repeater antennas.*

Home movies were made with wind-up or battery-powered 8mm movie cameras. Tape decks were for audio. Tripods were for film-type still cameras. Most TV signals were broadcast. Cable TV was rare, and satellite TV was little more than an expensive experiment.

Today's home movies are made using camcorders with tripod connections. New styles of electronic still cameras are coming out every day. Video cassette recorders are everywhere. Many have cable TV. Those who don't probably have cable-ready TV sets or recorders. Satellite TV systems can be purchased at the local mall or discount store. Times have changed, and so has ATV.

Getting started with ATV is much easier now. Many of the ingredients for a home television station may already be on hand. To make things easier, answers to frequently-asked questions can be quickly found on the Internet. In addition, there are magazine articles, columns and books about ATV, along with equipment manufacturers producing amateur television gear, ready for purchase, right off the shelf.

Ultimate simplicity

For those hams fortunate enough to have an active local ATV club running a well-located television repeater system, shifting a few wires in the shack may be all that's needed to receive ATV.

The local Houston, Texas, repeater (W5PZP) has a standard amplitude-modulated television output on 421.25MHz. This corresponds directly to cable channel 57. For those within a few miles of the repeater, signals can be received with a cable-ready TV set connected to an outside UHF antenna. The repeater transmitter is often commanded for continuous transmission of test patterns or information screens to facilitate testing of home and mobile receive equipment (**Photos A, B, C**).

For those who don't have a local TV repeater with output on 421.25MHz, there are alternatives. A nearby ham with an ATV transmitter can provide some video to test a simple receive setup. Most direct AM-ATV activity on 70cm occurs on 426, 434 or 439.25MHz. These frequencies correspond roughly to cable channels 58, 59 and 60. Home station transmitters are not generally used on 421.25MHz, due to the close proximity of the band edge at 420MHz. Suppression of the lower sideband components requires special filters, usually found only in commercial transmitters and better ham repeater systems.

The Houston Amateur Television Society (HATS) Web pages include a section describing "How to get on ATV CHEAP". Check out the Universal Resource Locator (URL) [http://www.stevens.com/hats/]. The suggested minimum system includes a simple 440MHz beam (the club sells an inexpensive kit), a mast-mounted preamp and a TV tuned to cable channel 57. With adequate height (outside and just above the roof), enthusiasts have been able to see the repeater out to 25 miles.

Many local OSCAR (Orbiting Satellite Carrying Amateur Radio) chasers

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6 Meter Antennas

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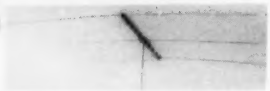

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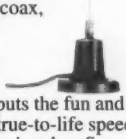

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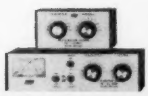
6 Meter MFJ Antenna Tuners



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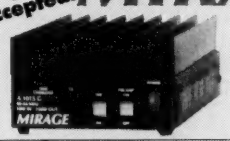

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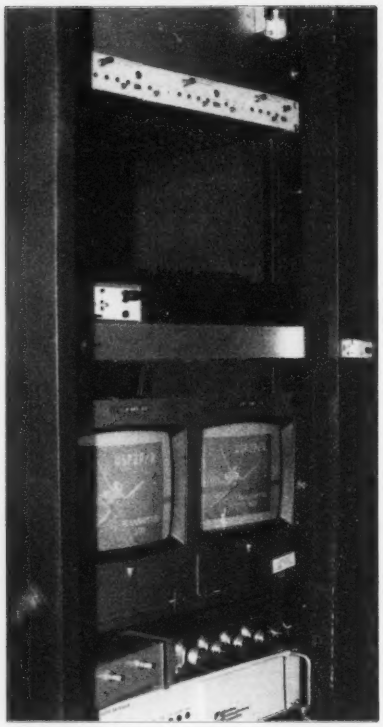

Photo B. *Monitors and controllers at the HATS ATV repeater transmitter site.*

have been able to use their 70cm satellite antennas to monitor ATV activity when the satellites are below the horizon. In addition to various ATV-oriented activities through the repeater, the Houston AMSAT net is carried on the local system.

The next level

Competition for spectrum within the amateur allocations continues to accelerate. ATV in Texas has not been immune to pressures from closed repeater and link systems in the 70cm band. For the most part, cooperation has won out over confrontation between the voice and video camps. While the audio-only link proponents have expanded into the traditional ATV 70cm spectrum, the video supporters have looked to higher frequencies for clear channels. The groups have worked together, to keep interference at a minimum for the 421.25MHz TV repeater channel, and to avoid the 435-438MHz satellite band.

The 23cm or 1.2GHz band is 60MHz wide. This bandwidth can support a lot of modes without conflict. The Houston group maintains an in-band FM television repeater on 23cm with an output on 1285MHz. This is the same signal that is transmitted on 421.25MHz AM, the preferred entry-level receive frequency.

While 1.2GHz television operation may at first seem to be a formidable task, only for radio and TV gurus, it is not. Many hams have put systems on line to receive 1.2GHz FM TV for less than $50. The methods are surprisingly simple, requiring no home-brew gear or design work.

The recent migration of satellite television viewers to K-band (12-14GHz) digital and subscriber systems has provided a surplus of older FM satellite receivers with inputs compatible with 1.2GHz ham television.

There are several types of satellite-TV receivers circulating on the ham swapmeet circuit. The one to look for is designed for the C-band (4GHz) or Ku-band (12GHz) LNB (low-noise block downconverter). The LNB is placed at the focal point of the satellite-TV dish. It amplifies the satellite signal and downconverts the 500MHz-wide passband to 950-1450MHz. This signal is typically fed through 75-ohm coax (RG-59 type) to the receiver. The receiver is tunable through the 950 to 1450MHz range, thus covering the 1.2GHz ham band, but is rather insensitive since it expects a rather strong signal from the LNB. Receivers of this type can usually be purchased for $30 to $70. The simpler, more inexpensive, receivers with analog tuning and few extras are easier to use for ham TV.

Getting one of these receivers on the air is simple: Add a preamp and a 1.2GHz beam antenna. The FM-TV signals broadcast by the TV satellites are typically wider than those used by amateur TV systems. Simply increasing the receiver's output video level will provide a quick fix.

Transmitting

While getting something on line that can receive signals from a nearby ATV enthusiast or repeater can be easy, transmitting TV is more challenging. Even if all the gear is purchased, rather than home-built, attention to detail is imperative. At 70cm and 23cm, RF connectors, cable and antenna quality is key. Most ATV stations incorporate "N" connectors, low-loss coax like Belden 9913 or better, and high-gain antennas. At 1.2GHz, even a 100-foot run of 9913 will lose up to 75% of the signal. Many stations with runs this long have gone to 7/8-inch hardline, or remote power amplifiers. Check the specifications, and buy the best you can afford.

ATV is a very unforgiving mode. If the path between two stations will support narrowband FM UHF communications at 40 to 50dB over S-9, TV will probably work. Trees and buildings can cause multipath problems, or ghosts, or may even prevent communication completely.

There are several sources of ATV transmitter gear. A few of the more well-known companies include HF Technology, (847) 639-4336; PC Electronics, (818) 447-4565; Pauldon Associates, (716) 692-5451; and Wyman Research, (317) 525-6452. Most also carry receivers, receive converters, preamps and antennas. Clubs like HATS have taken the initiative to design and build kits for antennas, preamps, filters and transmitters. This provides the club with funds for repeater repair and upgrades, while at the same time allowing members to get on the air for less money and to learn more about TV technology.

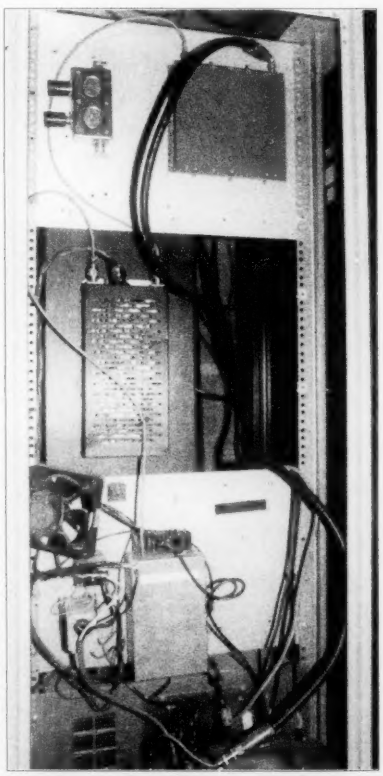

Photo C. *Power supplies and amplifiers at the HATS ATV repeater transmitter site.*

Why ATV?

Interactive television is an intense mode. Unlike typical voice communications, where you can monitor a conversation from the other side of the room while soldering a circuit together, ATV requires your attention. To participate in a "conversation," you must watch and listen. When transmitting, you may be running tapes, displaying devices in front of a camera, or trying to get a computer screen to look right over the air.

It's also not something that you do while mobile. In fact, it can be quite dangerous. A few hams in Houston have managed to rig cameras and transmitters that can run without intervention while driving, but they rely on the signal reports from monitoring stations to make any adjustments. It's illegal for drivers in many states to have a TV set in viewing range. Most ATV is done while at home, or at least from a stationary position.

After you've shown off the kids, dogs, cats, all the stuff in the shack and all the old home movies, what's left? The answer is only as good as your imagination. The South Texas Balloon Launch Team has been using ATV for many years to transmit live television back from altitudes over 100,000 feet (**Photo D**). The HATS group televises club meetings and license-upgrade classes around Houston. Unlike commercial broadcast television, ATV is two-way. Stations can "talk back" to the class or club meeting with either two-meter FM or their own live television.

HATS members also enjoy volunteer activity during community activities that use TV coverage for event coordination. Each year the members go to the streets to transmit live TV from the Houston Methodist Marathon and the March of Dimes Walk America (**Photo E**). As the club grows, so does the potential of the group to cover more events and provide useful public service. While event officials see live action along the course route, so do hams around town. Some experimenters use ATV on radio-controlled airplanes and cars, while others have even launched ATV in very large model rockets.

Due to the unforgiving nature of ATV, most hams pursuing this mode are constantly upgrading their equipment. More power, bigger antennas, and better feedline are primary targets. Station enhancements can include more or newer cameras, better lighting, video/audio switch boxes and VGA to NTSC converters to get computer images on the air. While ATV stations used to keep old ham license plates around for video identification (ID) screens, new inexpensive video titlers have taken over. Experiments with remote-controlled cameras and transmitters are also fun. In addition to activity in the 70cm and 23cm bands, efforts on higher frequencies past 10GHz are not uncommon. ATV is a good place to learn advanced RF techniques. You can "see" the results.

Photo D. *HATS member Rick Pense WD5BQN prepares for 1.2GHz ATV reception of a South Texas balloon launch.*

Finding out more about ATV is easy. A look at the Internet can get things started. In addition to the HATS Web page at [http://www.stevens.com/hats/], *Amateur Television Quarterly* Magazine (ATVQ) maintains pages via the same provider. Check out ATVQ's page at [http://www/stevens.com/atvq/]. Both HATS and ATVQ provide many links to clubs, manufacturers and distributors around the world. While at the ATVQ site, note that a magazine subscription form is part of the home page. ATVQ comes out four times a year and offers a fine magazine dedicated to the pursuit of amateur television. Henry Ruh KB9FO, the publisher, also offers an array of books and other publications. A very popular two-volume publication from ATVQ provides history, tutorials and technical information about amateur television. The first part is called *ATV Secrets for Aspiring ATVers* ($9.98). The second volume is much larger and is simply titled *TV Secrets Volume II* ($24.95). Henry and ATVQ can be contacted via phone at (219) 662-6396; FAX at (219) 662-6991; or by mail: 3 N. Court St., Crown Point IN 46307.

You will find articles covering many ATV construction, operation and information topics, including Bill Brown WB8ELK's ATV column in *73*. Bill takes on timely issues with insight on the latest gear and activities in this specialized niche of amateur radio.

I hope you get started with ATV soon—and *see* what you've been missing! 73

Photo E. *HATS members John and Stuart Ross provide live coverage of the Houston Methodist Marathon via ATV.*

How to See What You Hear

WARNING! This is easy!

Ron L. Sparks KC5ODM
24818 Lakebriar Drive
Katy TX 77494-1809

Anyone can bypass the hurdles and jump right into having fun with ATV. The good news is that very few ATVers feel threatened by anybody, so getting started is really easy! Notice that I said "threatened." Our hobby is plagued by two problems which make it unnecessarily hard for newcomers. Some readers may be offended by my assessment of these problems, but my objective is to make it easy and interesting for people to try out amateur television (ATV). I am not necessarily trying to be "nice." By being aware of the problems, things will be easier for newcomer and Elmer alike.

Both these problems arise from our strengths, so let's be honest about them. First, the strength and reliability that comes from a spread-out, redundant, self-healing organization causes information to be scattered and disorganized. Second, the technical expertise and practical know-how that create a unique membership often cause "outsiders" to be forced through barriers designed (subconsciously, I hope) to protect the "insiders."

If you want to test the second point, just pick a fight between the "outside" and the "inside" by honestly asking, "Why?" Then sit back and listen. A simple equation can be used: The volume and duration of the ensuing argument equals the strength of the threat the "inside" defenders feel. Typically, the more threatened they feel, the more arbitrary and difficult the hurdles to joining will become.

Five simple steps

1. Develop curiosity: The first step is to decide you are interested and begin looking at your options. The particular ATV avenue you choose to explore depends on your personal interests. Do you want to help a specific charity or organization with your skills? Do you want to aid in emergency response? Do you want to create a different view of the world by seeing from the level of your pet, your radio-controlled model, or the top of your antenna tower? Do you want to monitor some area remotely? Would you like to have a "looky talky"? Would you like to create a network of mobile cameras for traffic monitoring? Do you want an inexpensive way to experiment with microwaves? Are you wanting to try something really exotic like ATV via satellites? Do you want to see what the other ham is talking about?

2. Finding where you are: The next step is to find out where you are—in both a physical sense and from an equipment standpoint. One sidebar is a list of areas with activity in ATV. All of these areas are shown to have ATV repeaters and the list is growing daily. If you are not in an area covered by a repeater, do not give up. There is plenty to do even without repeater access. While you are checking the activity in your area, don't forget your local ham clubs. Most of the people in these clubs are willing to point you toward others with similar interests. There are even some clubs which are specific to ATV. In the Houston, Texas, area, HATS (Houston Amateur TV Society) is very active and devoted entirely to ATV. If you are already licensed, you have probably made the necessary contacts through the testing process, existing club, or local repeater. You just need to ask them about ATV.

If you are not yet licensed, this is where the first principle I mentioned earlier becomes a difficulty. It is often hard to find a club if you do not already know of one. Most clubs have a limited budget and operate by volunteer efforts. As a result they have limitations on how much general publicity they can do. A way to find them without Internet access is to contact the ARRL at 1-800-32 NEW HAM (800-326-3942) and ask them for contact information on Volunteer Examiners (VEs) in your area. These VEs will almost always be connected with a local club. They will also be interested in explaining how to go about getting licensed. By attending one or two club meetings, you will make the contacts you need to find the ATVers in your area as well as other ham information you may be interested in. If you are new to a club (even if you are not new to electronics or ham radio), be prepared for the second principle I mentioned to rear its head. Many club members have been in the organization for a long time and they forget how intimidating a room full of stony-faced strangers can seem to a newcomer. Just keep in mind that they enjoy the same thing you do or they wouldn't be there. Don't take the "I thought everybody knew that" comments as personal. They've been doing it so long, they really think everybody *does* know. A few honest questions will almost always open them up. One final tip: A wise friend told me, "Repeaters and ham clubs are a lot like your local bar or pub. Each has a different character of clientele. Move around until you find one that matches your personality—before long it will seem like a comfortable shoe."

Licensed or not, another good way to find ATV activities is by an Internet search. Increasing numbers of clubs and

individuals are putting up Web sites. The thoroughness of this resource is improving rapidly. Two Uniform Resource Locators (URLs) that are good starting points are the HATS home page at [http://www.stevens.com/HATS/home.html] and the Southern California (WA6SVT) ATV repeater page at [http://web.io-online.com/users/forsberg/atv.htm]. These pages have links to alot of ATV information and activities. The link pages can be reached from the above URLs or directly at [http://www.stevens.com/HATS/sites.html] and [http://web.io-online.com/users/forsberg/links.htm] respectively. If you're in need of general ham information or lots of links to good ham-related sites, you might want to try starting at [http://www.clarc.org/] or for those of you interested in what's going on in Europe, try [http://www.innotts.co.uk/~asperges/index2.html].While there isn't much in the way of ATV-specific software, the famous Oakland site is a wealth of ham-related information. You can enter at the ATV directory by using [http://oak.oakland.edu/pub/hamradio/dos/digital/atv/]. Just click on "Parent Directory" to move up and explore the whole ham radio tree. There is a file index at the HAMRADIO directory. Now that you know where the people, repeaters, and software are, it's time to jump in.

3. Planning where to go: The absolutely cheapest means to try out ATV is with a Receive-Only (RO) setup if you live within 25 miles or so of a repeater site. Most of you probably already have all the equipment and know-how it takes. **Table 1** shows that the 70cm ham band, often used for repeater output, can be received on cable-ready TVs or VCRs. Check the repeater directory or with your local club, and see if they are on one of the channels shown. If so, you can rig up an RO setup in 15 minutes. Just connect a good UHF antenna to the antenna input of your cable-ready set, but put it in the Cable-Ready mode. Then tune to the proper cable channel and you should see the repeater. Some people in the Houston area are even able to do this with rabbit ears! One note, however: Cable converter boxes will probably not work in this application. They are generally designed for the high-level signal from the cable and are not sensitive enough to work with an antenna.

You may need to experiment with whether to place the antenna horizontally or vertically. This depends on the repeater antenna polarization. Here in Houston, the output is horizontal and the input is vertical. That may be pretty common because it allows normal yagi or TV-style antennas to be placed normally (i.e., parallel to the ground) for receive. The transmit antenna back to the repeater can then be a vertical whip (great for mobile use).

But what about the antenna? That's not a problem either. The antenna can be a surplus UHF TV antenna, or you can build your own. I went the simple route and bought a kit from HATS for $15. Assembly took 20 minutes. It's giving me snow-free pictures even though it's mounted inside my attic and located 24 miles from the repeater. That $15 represents my *total* investment in getting started.

4. A piece at a time: The thing to remember is that this is a hobby. The fun is in the *doing*, not so much in the finishing. ATV is a great way to enjoy this hobby because it lends itself to little steps. For example, once you're receiving the local repeater you'll want to participate in any nets held there. This will usually take only a 2m handie-talkie (HT). There are now quite a few of these priced under $200 new. The local AMSAT Net is held here in Houston on 2m and is simulcast on the HATS ATV repeater. It is a real improvement to get to watch the net rather than just listen.

The addition of the 2m rig allows access to the control functions of the ATV repeater, letting the newcomer experiment with switching cameras, changing audio input, etc. Once you're comfortable with this, you will want to get on the air. A cheap way to experiment is to locate a source for the Rabbit™ transmitters that were frequently offered at discount department stores.

The early variety of units operated in the 900MHz ham band, and will allow you to experiment with different antennas, camera types, audio mixers, titlers, and other aspects of ATV. A camcorder is a readily available input device. Many older camcorders, especially ones with broken tape mechanisms, can be found at garage sales, pawnshops, and repair facilities almost for free. Photo supply mail-order firms often have very good prices on simple titlers.

Cable Channels in the 70 cm Ham Band

Cable-Ready Tuner Channel	Lower Edge of Band (MHz)	Upper Edge of Band (MHz)	Video Carrier Frequency (MHz)	Color Subcarrier Frequency (MHz)	Sound Subcarrier Frequency (MHz)	Cable TV Band Name
57	420	426	421.25	424.83	425.75	Hyper
58	426	432	427.25	430.83	431.75	Hyper
59	432	438	433.25	436.83	437.75	Hyper
60	438	444	439.25	442.83	443.75	Hyper
61	444	450	445.25	448.83	449.75	Hyper

Table 1. *Cable TV is on the ham bands.*

When you feel comfortable with these aspects, you can jump up to repeater input. Things may be a little different for those repeaters with 420MHz or 900MHz input, but the principles will be the same as you need for the 1280MHz repeaters. One of the big advantages of the higher-frequency inputs is the smaller size of the antennas required.

5. Keep it up: The last step is the real key. As you can see from step four, the possibilities are limited only by your imagination and desire. As with any new endeavor, you must keep looping back to the curiosity step, then progressing forward with a new aspect or component. This loop is the source of the fun and amazement that ATV can generate. Nothing keeps you from going down several paths at once, either. Right now I am building a 1.296GHz version of the Kent Britain WA5VJB antenna to hook to the HATS arrangement shown in **Fig. 1**. I

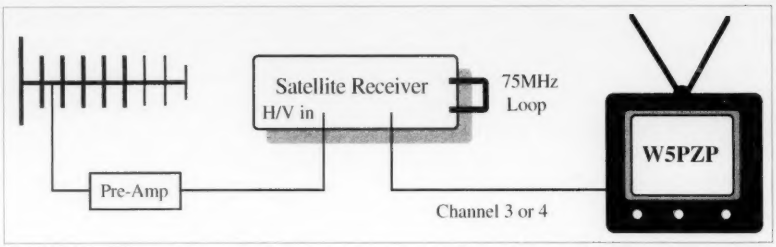

Fig. 1. *Microwave ATV on the cheap.*

Glossary of Common ATV Terms

ATV	Amateur television is often called ATV. Most often this means transmitting and receiving video and audio at normal speed. Sometimes called Fast Scan TV (FSTV).
Cable Box	A cable box is a set top converter which allows signals outside the normal broadcast band to be downconverted to channel 3 or 4 for viewing on any TV. These are not usually sensitive enough to be used in ATV.
Cable-Ready	A cable-ready tuner on a TV or VCR is designed to pick up signals outside of the normal broadcast band.
Composite Video	A composite video signal is one which contains the base band video with the proper (i.e. NTSC, PAL, SECAM, etc.) synchronization pulses and color information. This will typically have a voltage peak of about 1V and a bandwidth of 4.5 to 6 MHz.
Downconverter	In tuning the ATV frequencies on a regular TV some form of down conversion is required. While this may sound complicated to a newcomer, it is probably built into sets that are cable-ready.
DSB	Double Side Band is an extremely simple mode used for most microtransmitters. It is also wasteful of band and power. In all but the least expensive or smallest transmitters, the lower sideband is filtered out with a Vestigial Sideband (VSB) filter. Modern TVs will receive a DSB signal just as well as a VSB signal due to filtering in their IF sections.
FSTV	Fast Scan Television is a synonym for ATV. It implies that the transmitted frame rate and scan speed are the same as those of an international standard.
NTSC	National Television System Committee is the group that set up the way TV is broadcast in America. Because of its vacuum tube heritage, it is often jokingly taken to mean "Never The Same Color" from the way color is encoded. The picture is transmitted at 59.94 fields per second with two interlaced fields of 262.5 lines making one frame. The line rate is 15.734 kHz.
PAL	Phase Alternating Line is the TV standard for broadcast in the UK, Central Europe, Scandinavia, Asia, Australia, and much of South America and Africa. It comes in several "flavors" such as PAL-I which affect the way the sound subcarrier is transmitted. The UK uses PAL-I. The picture is transmitted at 29.94 fields per second with two interlaced fields of 312.5 lines making one frame. The line rate is 15.625 kHz.
SECAM	*Sequentielle Couleur Avec Memorie* is the French-originated TV standard that is used in France, Eastern Europe, Russia and the former Soviet states.
VSB	Vestigial Sideband filters are used in the transmitter to eliminate the lower sideband component. As with Single Sideband (SSB) phone transmission, this is the most power- and spectrum-efficient means of transmitting the signal. The main difference between a VSB and an SSB signal is that the carrier is still present in the VSB signal while it has been removed from the SSB signal.

ATV Activity Hot Spots

State or Country	Web Page	City or Region
Alabama		Numerous areas
Alaska		Fairbanks
Arizona	Yes	Pinal Peak and Phoenix
Arkansas		Little Rock, Harrison, Heber Springs, Russellville, Pine Bluff
California	Yes	Numerous areas
Canada	Yes	Numerous areas including Calgary, Winnipeg, Ottawa, Montreal, Regina, Saskatoon
Colorado	Yes	Numerous areas including Boulder, Colorado Springs, Denver
Delaware		Wilmington
District of Columbia		Alexandria VA; Rockville MD
Florida	Yes	Numerous, some NASA-related
Georgia	Yes	Atlanta, Dalton, Savannah
Germany	Yes	Numerous areas including Cologne and Lower Rhine/Dutch Border
Great Britain	Yes	Numerous areas including East Sussex, Kent, West Devon, and Coventry
Illinois		Decatur, Champaign, Des Plaines, Galesburg, Peoria
Indiana		Numerous areas
Iowa		Davenport, Des Moines, Dubuque
Kansas		Kansas City, Topeka, Wichita, Pittsburgh
Kentucky		Bowling Green, Elizabethtown
Louisiana		Baton Rouge, New Orleans, Shreveport
Maryland	Yes	Annapolis, Baltimore, Rockville
Massachusetts		Boston, Leyden, Springfield
Michigan		Ann Arbor, Saginaw
Minnesota		Minneapolis-St. Paul
Mississippi		Gautier
Missouri		Columbia, Kansas City, Joplin, St. Louis
Nebraska		Grand Island, Lincoln, Omaha
Netherlands	Yes	Arnhem, Eindhoven, Soest, Ulft
Nevada		Potosi Mountain
New Hampshire		Derry
New Jersey	Yes	Brookdale, Moorestown
New York		Ithaca, Finger Lakes
North Carolina		Charlotte, Greensboro, Shelby
North Dakota		Harwood
Ohio	Yes	Numerous areas including Columbus
Oklahoma	Yes	Oklahoma City, Tulsa
Oregon	Yes	Portland
Pennsylvania	Yes	Numerous areas, Carnegie Tech
Puerto Rico		East
Rhode Island		Providence
South Carolina		Lexington, Sumter
Tennessee	Yes	Numerous areas including Johnson City and the Tennessee Valley
Texas	Yes	Numerous areas including Abilene, Austin, Beaumont, Dallas, Houston, The Woodlands, Clear Lake, Midland, Tyler, Waco
Utah	Yes	Salt Lake City
Virginia		Numerous areas
Washington	Yes	Western Washington
Wisconsin		Numerous areas

have also put together a 7-ounce micro-ATV system for launch in my brother's model rocket. You could be having as much fun as we are! This is one facet of the hobby where I can officially close with "I'll be seeing you."

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4. Valkenburg, Mac E., *Reference Data For Engineers,* 8th Edition, Butterworth-Heinemann, 1993.

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6. [<http://www.users.interport.net/~ jbay /theatre-sound/tv-2.html>]. This file has some very good information and was used to cross-check the Hyperband Cable frequencies, but it appears to have a minor error. When compared to Reference 4, above, the frequency stated as "Picture Carrier" in this table is, in fact, the lower band edge. The "Picture Carrier" or Video Carrier would be +1.25 MHz from this edge, not -1.25.

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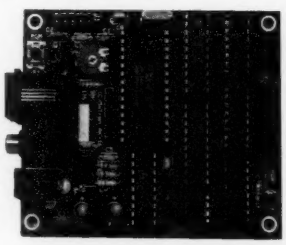

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Rick Pense WD5BQN
1511 Brickarbor
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E-mail: [WD5BQN@stevens.com]

In keeping with the amateur tradition of using the cheapest means possible to accomplish results, I have assembled complete 1.2GHz receive systems from old satellite receive equipment. The desired satellite receivers are known as block downconverted receivers. In their original implementation, they act as a tunable IF strip. The frequencies that they are designed to tune are 950MHz to 1450MHz. This makes them excellent candidates for use as receivers in our 1.2GHz FM ATV band. The front end of these receivers is very broad, so simply attaching an antenna to them usually gives poor results—you're weighed down with reception of broadcast TV signals, paging transmitters, cell phone intermod, and other signals. Also, they aren't usually very sensitive, so you have to add some type of preamp to bring the received signal up to the input level the receiver wants to see.

The first problem, that of the undesired signals, is cured by using a waveguide transition made from coffee cans as an antenna. The design for this feedhorn is available in various books and magazines, but it's simple enough to run through right here. Solder two 34.5-ounce coffee cans together so that only one end remains sealed. Place a type-N connector with a two-inch #14 wire soldered to the center pin three inches from the sealed end. You now have a 10dB "cantenna" to use in front of your receiver.

The hardest part of this project was the preamp. High-gain, low-noise preamps for use at 1.2GHz are not cheap. I found a solution in an old copy of *73*. C. L. Houghton WB6IGP, in his "Above and Beyond" column (May 1993), described a conversion of old satellite LNAs (low noise amplifiers) for use as preamps on spectrum analyzers. These LNAs were used on the earlier-style TVRO satellite systems and they were designed to pass 3.7 to 4.2GHz. His instructions to cut the horn feed off and attach a type-N connector are okay if you've been around microwave equipment for a while, but I think it's time to give a more detailed description so that others can enjoy the kind of fun we're having here in Houston.

"We just ask homeowners with incorrectly-aimed dishes if we can have the LNA."

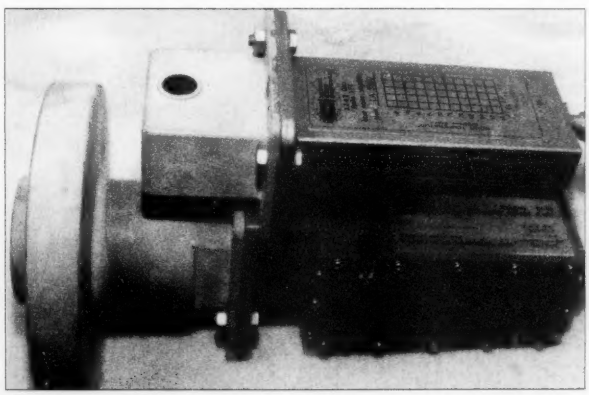

Photo A. *Two LNAs and a two-axis feedhorn, hot off a satellite dish.*

First, find an LNA

The LNA is easily identified by the type-N connector on one end. We have a lot of luck finding these LNAs around Houston: We just ask homeowners with incorrectly-aimed dishes if we can have the LNA, if they aren't using the dish (see **Photo A**). Sometimes the owner says yes, but only if we take the dish—which is fine—these dishes perform well at 1.2GHz. I have a six-footer on my van, with a cantenna feedhorn, which has worked our repeater from numerous special events locations.

Place the LNA in a vise and carefully cut off the waveguide input section, leaving an area to mount the type-N connector (see **Photo B**). Remove the screws which hold the cover on the preamp. If a circulator/isolator is in your preamp, it must be removed. Look around inside the preamp to see how the unit was originally assembled. It may be necessary to remove all the screws and unsolder and remove the type-N connector to get the isolator out. The isolator must be removed as it is a narrowband device and we are moving

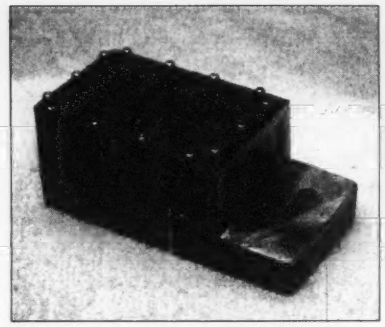

***Photo B.** Waveguide has been sawed off.*

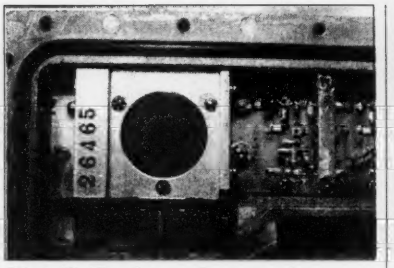

***Photo C.** Circulator to be removed.*

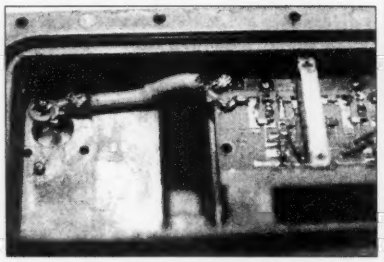

***Photo D.** Circulator removed and coax installed.*

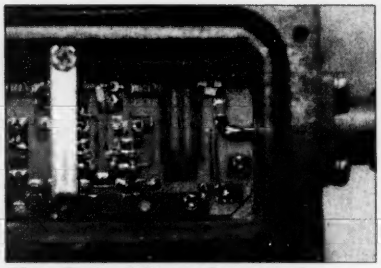

***Photo E.** Comb filter to be removed.*

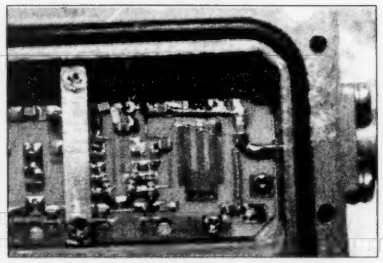

***Photo F.** Comb filter bypassed with wire jumper.*

the designated passband down quite a bit (see **Photos C** and **D**). With the isolator removed, reassemble the preamp and mount a type-N connector near or in the hole where the original 3.7GHz waveguide probe was. Use either mini hardline or double-shielded mini coax to connect the type-N connector to the preamp's input. When you place the connector and its mounting be sure it's sealed watertight, because the LNA was designed to be mounted outdoors, and it'll take a beating from the elements. Both the center conductor and the shields of the coax must be attached to prevent oscillation of this very high-gain device. These units have an advertised gain of 40dB, and we have measured one device which had 60dB of gain with a 2.5dB noise figure after modification.

At the other end of the preamp, a comb filter may be included to limit the passband of the preamp. Removal of the filter is accomplished with a hobby knife. Only the tips are left, and a wire jumper is installed across them to try to keep stripline integrity (see **Photos E** and **F**).

You tweak the amp (if necessary) by removing or relocating blocking capacitors on the striplines. Older-type amps have two blocking caps on the microstriplines which decouple the stages in the preamp. Removal of the capacitor nearest the GaAsFET electrically lengthens the microstrip, lowering the operating frequency. Be careful to prevent oscillation, as these are very low-noise, high-gain GaAsFETs in these amps. Generally, amps with five or more active devices should not be tweaked. Amps with three or four stages can be heavily massaged to lower their operating frequencies. Coupling capacitors between stages can be increased to aid low frequency response. Usually, while tweaking, I will simply add a capacitor beside the original in case removal is required later. Tweaking is a trial-and-error approach, and should not be a substitute for proper preamp design.

When completed, the modified preamp is a gain-block type of device. It should be very broadband, very sensitive, and fairly quiet. Use on other bands or modes is possible—Phase 3D comes to mind. The same requirements for frequency selectivity mentioned about the satellite receivers apply to these LNAs. Some type of frequency-selective filtration must be applied in front of the amp. Use of a commercial 1.2GHz yagi directly into the preamps was unsatisfactory.

We've had some success in Houston with a two-cavity filter which allows full duplex operation on 1.2GHz. Separate antennas and careful placement are required. We transmit on 1.255GHz and receive on 1.285GHz. The use of these satellite receivers, only 30MHz removed from 18W transmitters, has proven them a practical substitute for much higher-priced commercial FM ATV receiver systems. 73

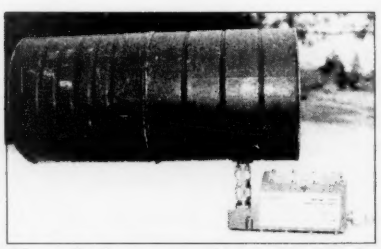

***Photo G.** Cantenna and preamp ready for service.*

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Video Titlers for ATV

If you're serious about ATV, a video titler is the way to go.

Fred Juch N5JXO
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Houston TX 77079
E-mail: [N5JXO@stevens.com]

In the 10 years I've been involved in amateur television, I've used just about every type of station video identification scheme possible. I began with an old Vidicon camera with an on-screen titler. I've used posterboard in the station background. I have even tried CGA computers to generate the proper ID screens. All work fine, but...

A video titler will overlay your video screen with text information. Similar to national news broadcasts, you can put your ID in the corner of the screen, or you can use scrolling or crawling text. The units reviewed here are the low end of the current consumer market. They are intended for home video editing or adding titles to home movies. If you put a video titler as the last device in the video line before your transmitter you will always be able to send your ID independent of your video source.

You can spend hundreds of dollars (the Videonics Titlemaker 2000 runs about $650), but the three most popular (in the ham community) titlers under $150 are the Sima ColorWriter Magic ($139.95 at this writing), Sima ScreenWriter ($99.95), and the Ambico V-6350 ($119.95). All are available via mail order.

They have very similar features and performance. All have memories, can crawl text across the screen (right to left), and scroll text up the screen. They differ in the number of colors, amount of memory, and font sizes. I know hams active in ATV using all four titlers mentioned above and each would tell you theirs is the best for their specific application.

Photo A. *Video titlers come in different shapes and sizes.*

All three titlers evaluated below run on 9 volts DC from a wall transformer. Each has a 7805 voltage regulator inside, so they should run off 13.5 volts if you take care to add a heat sink to the internal regulator (for portable use). The keyboards have rubber keys, and support special characters for international languages. All are in plastic cases although the Ambico V-6350 has a metal baseplate (the heat sink is not connected to that plate, however). S-video inputs and outputs are also standard on all but the ScreenWriter, and the Sima units are available in PAL as well as NTSC models.

I bought and/or borrowed each of these titlers, and evaluated them to find the best features of each. All operated as the manual said they should. After getting familiar with each unit I was able to quickly create ID screens and use the special effects like a professional. Here is an in-depth look at each unit and how it operates.

Sima ColorWriter Magic

The ColorWriter Magic is the largest of the titlers, measuring 13.75" x 8.5" x 2.5" high. It has 13 screen memories, a standard-size keyboard, and boasts eight colors. For battery backup of memory two LR44 button batteries are included, and are stated to last six months. This is the only unit (of these three) with a full size keyboard, so there is a lot of empty space in the unit for home-brew projects. (Maybe a VOR timer circuit?) The ColorWriter treats text and special effects separately. The only data in

memory is the text and color data. To create output the operator selects the page of memory, then what effect is desired, then "Insert." The last two screens of memory are reduced text pages and are used with the zoom feature. One page is a Headerline that can be displayed along with any other screen. The Headerline is great for putting your callsign on screen, while you scroll through other information simultaneously.

The colors (black, red, green, yellow, blue, magenta, cyan, white) are selected on the special section on the keyboard labeled "Color Select." There are five variations possible with these colors, including colored letters, boxed letters, bordered letters, reversed letters, and colored background. The boxed letter looks like a square of any color, with the letter in it, also of any color. Bordered letters are letters of one color outlined with another color. I usually outline with black for clarity. A neat trick this unit will do is reversed letters. That's not the same as backwards letters—if you select a color, then select reverse, the outline will be the color selected and the letter will be transparent—a neat effect for a callsign. All six colors are available in any combination.

When you select a memory location, then press "Create," the screen fills with small squares for editing. You can select colors, background, etc., and then start typing. The special colors can be edited later, one character at a time. The biggest annoyance is the lack of word wrap. You have to hit return at the end of each line. If you edit a page you may have to retype the entire page to add text at the top of the page. The editing keys allow you to adjust one of four character sizes for the entire page only; one of four scrolling speeds; and basic move/add/delete functions.

The insert keys allow the basic functions of inserting your screen on top of the selected video. You can do this in several ways. One function is fade in or out. Others are the scroll-up screen, and scroll across the bottom of the screen. Two of the memories support a zoom feature. This stunt is so crude it should not be considered a feature. It places text in the center of the screen, then enlarges or reduces the font size to simulate zooming in or out, but the font sizes are not proportional, and the results are awkward.

The special effects section of the keyboard allows you to move text onto or off the screen in one of six special ways:

- The entire screen can be brought into view from the right side of the screen.
- Alternating lines can be brought onto the screen from opposite sides of the screen.
- Lines can be brought onto the screen from the right, one line at a time.
- Text can be scrolled down the screen from the top.
- Text can be entered as if typing on the screen, one character at a time.
- Text can be scrolled up from the bottom. This is the best feature of the special effects section of the keyboard, as it makes text exit as well. For example, you can make the text enter from opposite sides of the screen. It will stop when text is all on-screen. You can then select "scroll up," and the text will slowly move up the screen until it is gone. The horizontal motion moves in jumps, one character space at a time, but the vertical scrolling is very smooth.

The ColorWriter is very versatile, and has enough features for creative ATV use. The colors can be mixed to produce exciting and brilliant on-screen text. The drawbacks are no flashing characters and only one available font. The special features will appeal to anyone who will be using this unit to put titles on tape for later viewing or transmitting. I also found the special effects fun to play with while transmitting over the local ATV repeater.

Sima ScreenWriter

The ScreenWriter is the smallest titler, measuring in at 11.5" x 4" x 1.5" high. The memory is backed up with a single CR2025 or CR2032 battery, and should last one year before replacement. It also has 15 memories, three of reduced size that are reserved for the Zoom feature. Also the ScreenWriter only puts out white text. This unit does have a demo mode that is activated by pressing the "Down" key after you power on.

This unit is operated like the ColorWriter discussed above, with a few exceptions. The unit cannot create a backdrop to put text on; you must have a video source connected to use it. The text can't be set on a block background, outlined, or reversed. There is one font, with four font sizes, so the keyboard is very simple and straightforward.

- Create: In the create section of the keyboard you have keys to select page number, font size, and the editing functions (add, delete, line shift). These will allow the entry of data into the memories for later viewing.
- Insert: The insert keys allow a memory screen to be displayed over incoming video. The limited functions available are Zoom In, Zoom Out, Scroll Up, Scroll across the bottom of the screen, and Cut in and Cut out. One amazing discovery is that the Zoom feature actually works! And it works on Zoom in and Zoom out. The reason it works is that the fonts are more proportional than on the ColorWriter. Only memories 13-15 can be used with the Zoom feature.

The ScreenWriter can add a callsign to a screen very nicely, for a small unit. It can also scroll text across the bottom of the screen, or up the screen. I think of this unit as a good tool that will get the job done, but with no bells or whistles. I also missed the Headerline feature available in the ColorWriter. If you are going to attach a unit to the handlebars of your bike, or on a portable camera, this may be the unit for you.

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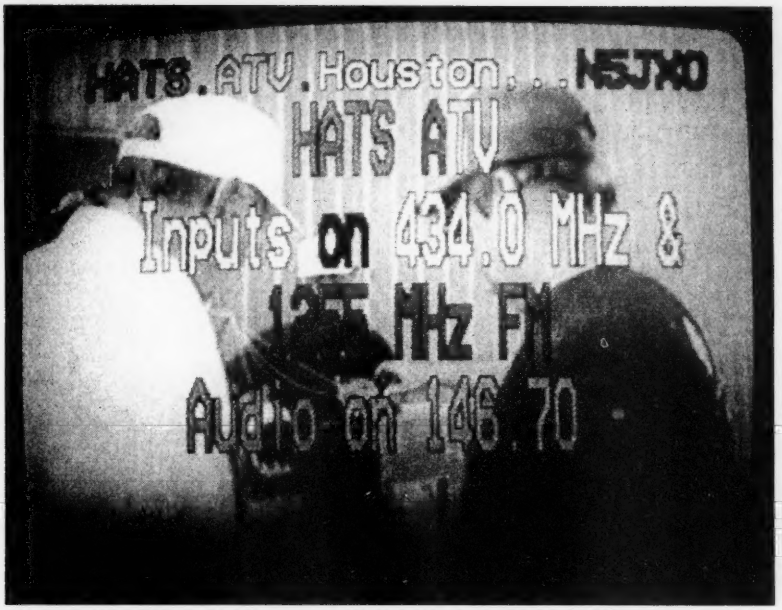

***Photo B.** Sima ColorWriter screen with Charlie Keng N5XGW (right) shows Headerline at top with larger size text in center, all outlined in black.*

Ambico V-6350

The Ambico is a slim 10.5" x 6.5" x 2" high and has 10 pages of memory; for battery backup of memory, two AA batteries are needed. The V-6350 can generate eight colors, but only four at a time.

The Ambico V-6350 has an adjustment knob on the back to set the width the image takes up on the screen. This allows the text width to be set so that it stays in the screen's viewable area. The "Mode" key is used to select how text is entered, manipulated through the use of special effects, and displayed or played back. This unit, like the ScreenWriter, has a demo mode to help you learn what can be accomplished with the titler, but the philosophy here is a little different. The memory not only holds the text, but also holds all the text manipulation information. This is very similar to making a small movie containing information and actions.

• Edit: To start entering text, first select "Page," then 0 through 9. Now choices can be made by selecting options on the edit screen. The background can be video, or solid white or black and is selected with the "Background" key. The flashing cursor indicates the color of text to be entered. Pressing "Color" will select one of the four colors shown in the color selection boxes on screen. Pressing "Shift" *and* "Color" will allow changing the colors in the four color-select boxes. The end result is that only four of the possible eight colors can be used on any one screen. Size is set for each line individually, and has four settings.

The text borders can be set to solid-color, color-filled outline, or hollow outline (transparent characters). Two fonts are available: one called normal, and one called narrow. The narrow font has only upper case characters. Unlike the other units mentioned above, the V-6350's characters can also be set to flash.

• Effects mode: After the text is created (in edit mode), pressing the mode key moves the unit to effects mode. There are four ways text can be brought on screen: cut in; scroll in; crawl along the bottom of the screen; and wipe in. Wipes can be from top, bottom or center of the screen. A delay of up to eight seconds can be included before the text exit effect is performed. The exit effects are: cut; scroll out; and wipe off. Again, wipes can be: from top and bottom; from the bottom; and from the top. Three speeds can be selected with most effects. One caveat, however, is that the V-6350 can't scroll in and scroll out on the same page.

• Active mode: To play back the text, the "Mode" key is pressed again to reach "Active" mode. Here the memory pages can be played back like small movies, individually, or in an automatic mode that goes sequentially through the pages.

The Ambico V-6350 does a good job of putting color text on the screen. The playback mode allows pages to be played back in a smooth predetermined method. The small size makes it good for cramped shacks or field work, but I was disappointed with the lack of background colors and the limited color selection. Also you have to fully program all aspects of a memory page before playback is possible. Another drawback is that the Ambico drops off-line if the overlaid video is interrupted. This could be a problem if the input is switched between non-genlocked sources. But at this price it can easily fit into most ATVers' budgets.

Although all the units reviewed provided good quality text on a stable video source, all got the wiggles if the source was much less than perfect. And none had the ability to loop on an action, such as scrolling an information message over and over. The Headerline feature of the Sima ColorWriter was nice, but the Ambico is the only unit that offers flashing text. I believe the Sima ColorWriter is the most versatile titler. With the Headerline feature it offers a stationary text line while other text is scrolled or crawled across the screen.

Still, any of these titlers beats a piece of cardboard on the wall for passing information. All have been in operation for at least six months and are still working flawlessly. Are you old enough to remember the old RTTY pictures made with text? With these titlers you can save the pictures in memories and recall them whenever you want. It's time to break away from those old graphics and put a polish on ATV shacks around the world! 73

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CIRCLE 167 ON READER SERVICE CARD

73 Review

Dr. NiCad Battery Conditioner/Rapid Charger

Ramsey Electronics Model No. DN-1

Mark L. Meyer WUØL
14153 West First Drive
Golden CO 80401

Photo A. *The Ramsey Dr. NiCad kit (all photos by author).*

How many NiCd battery packs do you have sitting around the shack? If you're a typical ham, the answer is probably at least two for the handheld and several more for various pieces of equipment—and maybe a few for assorted tools, toys, etc. I started looking around and counted half a dozen at this QTH. Some of the packs were functional, and some were dead; but even the dead ones are too expensive to throw out.

So what do you do to charge all those batteries? Are you charging them correctly? NiCds should occasionally be *nearly* fully discharged and then fully recharged to keep them in good condition. Are you doing that? Is your wall recharger overcooking your batteries when they are connected for weeks on end? What about those dead batteries—can you restore them?

Enter Dr. NiCad

The good doctor can handle all these chores for you, plus provide fast charging for your batteries—without overcooking them. The doctor is available from Ramsey Electronics in kit form or fully assembled. If you order the kit, you can get the basic circuit board and parts only. An optional case set can be ordered to go with the internals.

The heart of Dr. NiCad is the Benchmarq BQ2003 chip specifically designed for NiCd charging. It is programmed by external jumpers on the board and switches to sense how many cells are to be charged, what charge rate is to be used, what discharge rate is to be used, and how long the pack should be charged. The chip senses the correct points to discharge the cells to, at what point to start/stop the quick charge, automatically provides a "topping off" charge and then "tops off" the batteries periodically. It also flashes an LED in various sequences to tell you what is happening.

I got interested in Dr. NiCad when I built a new QRP transceiver. For battery power, I connected two 7.2V NiCd packs together to make a 14.4V pack. The 7.2V packs are commonly used in video camcorders. My packs were rated 1,000mAh (milliamp hours). A 7.2V pack contains six individual cells in series, so I had 12 cells connected in series. The rated pack voltage divided by 1.2 gives you the number of cells in the pack.

Most packs used in handhelds contain from six to 10 cells (some contain 11). NiCds for toys and tools may contain from only one cell to several. As explained above, I wanted to charge 12 cells. As supplied, Dr. NiCad can handle from one to 10 cells but it is easily modified to handle more cells. The number of cells to be charged must be set in the unit by toggling the individual switches on a "DIP" switch unit on the circuit board. Since I wanted to charge more than 10 cells, and I wanted to be able to change the number of cells to be charged from a front panel switch, I modified the unit as described below.

Kit parts and assembly

I ordered the basic kit, consisting of the PC board and the parts to stuff it with. The kit comes in a large plastic bag containing the instruction book, a couple smaller bags with the parts, large schematic diagram of the unit, and a large parts placement diagram.

The instruction book is well done. In addition to showing you how to put the parts together, it gives a fairly detailed explanation of the process of charging NiCd batteries, a troubleshooting section, and a question-and-answer section about operation of the unit. The actual assembly portion has a check-off table for each part; this, combined with the parts layout drawing, makes it very difficult to err in putting the kit together.

The circuit board is high quality and silk-screened with the parts layout. The parts were all present and were high quality although some appeared to be surplus as the leads were clipped. Everything fit and assembly went smoothly.

The heat sink for the transistor that is used to discharge the NiCd packs appeared to be undersized to me, especially since I wanted to use a 12-cell

pack. I beefed this up by bolting on additional aluminum strips. Also, no heat sink compound was supplied to apply between the transistor tab and the heat sink (I added a dab I had on hand). No lockwashers are provided (I used my own).

Modifications

As mentioned above, I wished to charge a 12-cell pack. The unit as provided is designed to charge up to 10-cell packs. How many cells are to be charged is determined by a series string of 47k resistors. This is a voltage divider string. The switches on the circuit board (S1:1–9) merely short out the correct number of resistors as desired. If only one cell is to be charged, all the resistors in the string are shorted out except one (hence the nine switch positions on S1). This one resistor is permanently left in the circuit as designed and cannot be shorted by the switches, as explained in the instruction book.

To modify the unit for 12 cells, two additional 47k resistors must be provided, plus two additional switch positions. I elected to use a front panel switch instead of the circuit board-mounted DIP switch that contained the nine individual switches for shorting the resistors. I used a 12-position rotary switch available from Radio Shack™. I also mounted all the switched resistors (now 11 47k resistors instead of nine) right on the switch tabs instead of on the board. This way only two wires go from the new switch to the board—one from the arm of the switch, and one from the top of the resistor string to the board (**Fig. 1**).

The DIP switch also contained one individual switch (S1:10) to set the discharge rate. When this switch is closed, a low discharge rate is selected. When it is open, a high discharge rate is selected. I decided a low rate was appropriate for all my uses, so I simply jumpered (shorted) the S1:10 holes on the board. Using an additional front panel switch for this function would make it selectable but I didn't choose that option.

I provided my own case. My case setup didn't allow for the use of the "on-off" power switch (S3:A) provided on the circuit board or the "discharge initiate" switch (S2), also provided on the circuit board. I didn't use the switch provided; I simply brought wires from the appropriate holes on the circuit board to the switches I provided on the front panel of my case. The "on-off" switch is just a normal toggle switch but the "discharge initiate" switch is a momentary push-button switch.

Setup

As mentioned above, the discharge rate can be set at a low rate of 140mA or a high rate of 280mA. I decided the low rate of 140mA would be fine for nearly all use. The low rate reduces the heat dissipation of the current pass transistor and the only disadvantage is that it will take longer to discharge than the higher rate. Set the low rate by closing switch S1:10, or by shorting the switch position with a jumper wire as described above.

The charging current rate can be set at 250mA, 500mA, or 1A by positioning several jumpers on the circuit board. The instruction book explains how to calculate the best setting for your pack and then how to set the jumpers. I decided the 500mA setting would be fine for my packs. This too could be set up by switches to make it selectable but would be a little complicated. I used jumper wires as described in the book.

The charging time-out feature is also set up by jumpers. The instruction book tells you how to select the correct time (180, 90, 45, or 23 minutes) for your pack and set the jumpers. I selected 180 minutes for my application.

Power supply

The unit, in kit form or fully assembled, does not provide a power supply for charging your NiCds. It is the controller; you must provide a regulated source of power for the unit. The instructions recommend a "regulated"

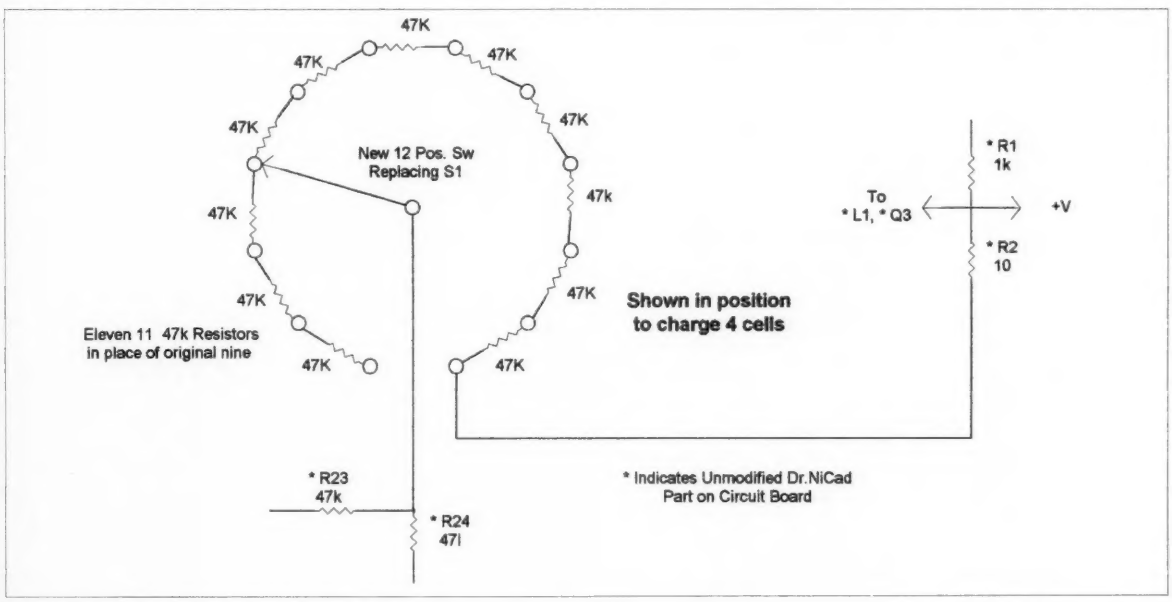

Fig. 1. Modifications to accommodate 12 cells.

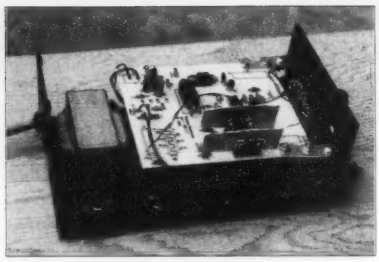

Photo B. *The interior, with modifications. Note the extra aluminum strips bolted to the heat sink of the discharge transistor (Q3). The power supply board is mounted below the Dr. NiCad board with the transformer to rear.*

supply between 12 and 14VDC capable of at least 1.5A. Most hams have such a supply in the shack already.

I wanted to have the power supply and controller all in one case. I also wanted to charge up to 12 cells, so I decided I would need to provide a slightly higher voltage. The instruction book indicates some problems can be encountered when too high a voltage is utilized with a low-voltage battery pack. With this in mind, I decided to build a supply that could provide a high or low voltage depending on what I intended to charge.

The circuit in **Fig. 2** shows the power supply circuit. It will provide approximately 11V in the "low" position and 18V in the "high" position. The regulator chip, U1, should be a LM317T. The "T" indicates the capability of 1.5A. This is in the full-sized TO-220 case rather than the "MP" series with the smaller tab (rated 0.5A). Use a heat sink with heat sink compound on U1.

The transformer should be rated approximately 18V at 1.5A. I used a 24V transformer (from my junk box) with some secondary turns removed to bring it down to about 20V. Radio Shack™ 273-1515, rated at 18V and 2.0A would be ideal. If you won't be charging a pack of more than ten cells, the Radio Shack 12V, 2A transformer (RS 273-1511) will do the job for T1. In this case you will not need the switch or R3. R2 should be replaced with a 2.0k unit, which should result in a power supply delivering approximately 12V. If the 2.0k resistor is increased slightly in value, the voltage will increase correspondingly.

My unit worked great when I fired it up. I charged up (and discharged) several packs, then tried a pack that was "dead." By cycling the pack several times over a few days, as described in the instruction book, the pack was revived!

I tried another "dead" pack. No matter how many times I tried cycling, this pack remained dead. Three cells out of seven seemed to be shorted. Then I tried an old trick of applying a heavy dose of current to the three shorted cells. I *very* momentarily applied a full 12V from a lead-acid battery to each individual cell. This seemed to cure them. Then I cycled them several times with the good doctor. *Presto!*—another pack restored. **Caution:** If you try the heavy-dose-of-current trick, *be very careful!* Cells can rupture. Use long leads—and place the cells and battery around the corner, or behind something, so you're out of the line of fire should one blow up.

I am very impressed with Dr. NiCad. This is something that should be in every shack. My unit has paid for itself already by restoring two dead packs—and I expect many more years of service from the good "Doctor."

The Dr. NiCad kit (DN-1 @ $49.95 for the kit only) is available from Ramsey Electronics, Inc., 793 Canning Parkway, Victor NY 14564.

The modification parts I used are:

SW1 – Single Pole, 12 position, Radio Shack #275-1385

T1 – Radio Shack #273-1515

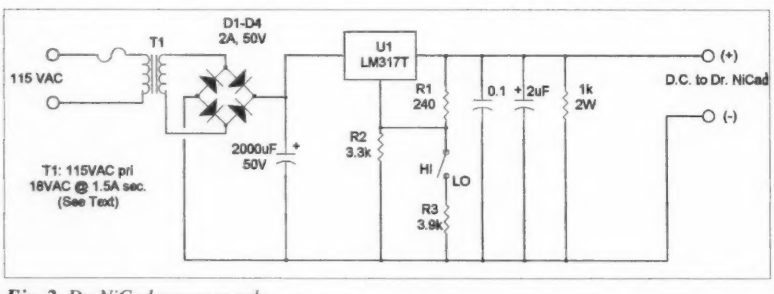

Fig. 2. *Dr. NiCad power supply.*

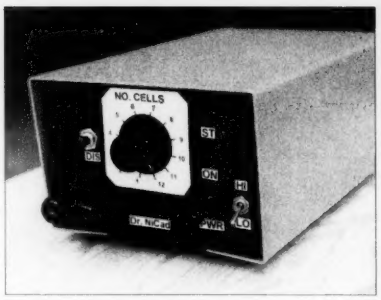

Photo C. *The finished project.*

D4 – One 2A, 50V bridge unit or four RS-276-1661 (3A)

U1 – LM317T (Digi-Key) 73

NEVER SAY DIE

Continued from page 5

need is to elect some new younger hams to the ARRL Board to kick that stodgy old organization in the rear to get it moving. And that's entirely up to your club, which is probably also run by a bunch of old-timers, mired in 1930s thinking.

Your choice for amateur radio: grow or go.

Xtal Sets

Have you seen any snot-nosed kids around who might be helped on their downward path in life by an injection of the hamitis virus? This is one virus that not even the bioelectrifier can cure, and it's simple to administer, even in full sight of the parents.

How about sucking the unsuspecting protonerd in with a very simple crystal radio that can be built in about an hour? The parts? Some Tinkertoy spools to support a loop antenna, wire for the antenna, a pair of headphones from the kid's Walkman™, a diode and a tuning capacitor made out of aluminum foil?

Well, that's about what led me into a lifetime of hamming. An angel, or a devil, depending on your viewpoint of me, brought a box of old radio parts into the Dutch Reformed Church I was attending when I was 14. He gave them to my best friend, Alfie, who had zero interest in such junk and dumped 'em on me. I found a circuit in *Popular Mechanics* that used some of the parts to make a cigar box radio. Unfortunately, it worked and I was hooked. For life.

You'll find 15 easy-to-build crystal radio projects in the new *Crystal Set Projects* book from The Xtal Set Society, Box 3026, St. Louis MO 63130. Some great stuff here for science fairs, or even for science classes. The 160-page book is $17.50, including s/h. Be an angel or devil and get busy poisoning some dirty little minds with this book.

Oh Oh Ozoned

A reader sent me more data on the ozone

Continued on page 30

Antennas for Amateur Television, Part 1

An overview of the most useful.

Nizar A. Mullani KØNM
719 Santa Maria
Sugar Land TX 77478
E-mail: [KØNM@amsat.org]

Antennas play a major role in the transmission and reception of P5 pictures in amateur TV. Unlike commercial broadcasters, which transmit with millions of watts of effective power from thousands of feet up, amateur TV is usually limited to a few hundred watts of effective radiated power from a couple of hundred feet of height. Therefore, the signal levels in ATV are much lower than for commercial TV, and high-gain antennas are necessary to provide high gain in both the transmission and the reception of the signal. And, in the fringe areas of reception, a high-gain antenna can improve the signal strength sufficiently to overcome the noise so that a picture is visible.

Several designs of antennas are used for ATV, which operates from 420MHz and higher. As the frequency of operation is increased, antenna sizes become small enough to consider designs that would be prohibitively big for VHF operation. Some of these designs, which we'll touch on in this article, have features that make them very attractive for ATV, such as ease of construction and use.

This first article in a two-part series will cover a few of the more common designs, while next time we'll discuss the esoteric antennas.

The yagi

Most amateur radio operators are familiar with the yagi antenna, which is one of the most efficient antennas for producing high gain with the smallest amount of space and material. Its operation is based on the principle of mutually coupled radiators that are resonant at the frequency of use, and which combine with the fed radiator to produce a unidirectional radiation of energy from the antenna. In other words, a dipole radiator, when placed adjacent to another dipole, will couple energy into the adjacent dipole and the two dipoles will then radiate a pattern as if they were two phased dipoles. The two radiators are then said to be mutually coupled because they can interact mutually with each other. By changing the length of the adjacent dipole and its spacing, the phase of the coupled energy is changed and the radiation pattern can be made unidirectional.

As an example, if an element is made 5% longer than the resonant frequency and spaced 0.2 wavelengths away, it will act as a reflector while an element made 5% shorter and placed 0.1 wavelength away will act as a director. Adding more elements in the antenna concentrates

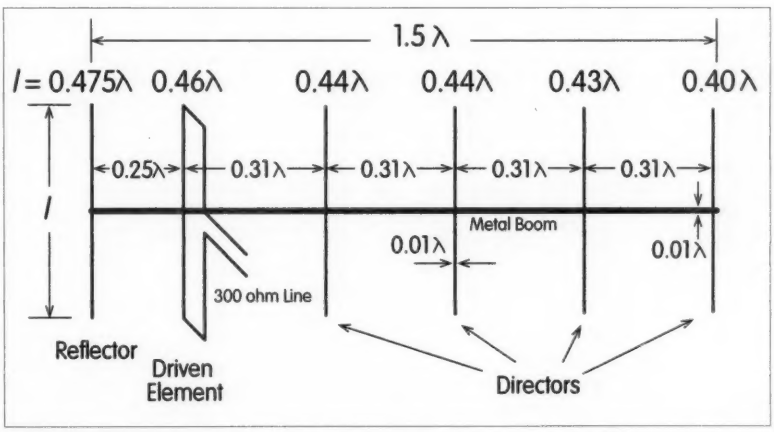

Fig. 1. *Typical yagi antenna with one reflector, one radiator, and several directors.*

more of the radiated energy into a narrow beam of radiation and increases the gain of the antenna. A typical design for VHF and UHF uses a radiator, one reflector and multiple directors as shown in **Fig. 1**.

The yagi antenna does have its limitations, though. Antenna gains higher than 12dB become harder to produce because of three major factors.

The first is that several directors are required to increase the gain, which in turn increases the length of the boom significantly. As an example, to increase the gain by 2.5dB of a yagi antenna (from 12dB to 14.5dB) requires a doubling of the boom length (from 2.2 to 4.4 wavelengths) and almost doubling the number of directors as shown in **Fig. 2.**

The second is that longer boom lengths require more critical construction so as to reduce the losses caused by errors in spacing of the elements and the critical dimensions of the directors. At high frequencies, such as the 1.2 and 2.4GHz bands, small errors in the size of the directors and reflectors can have major influence on the gain. Therefore, high-gain UHF yagis become very long—and very difficult for the average ham to build.

The third is that yagi antennas have a very narrow band of operation and often have to be tuned to the specific frequency of operation.

Other avenues

There are several alternatives to the yagi antenna for use in the 400MHz and higher bands that have high gains, that are easy to build, and that do not have the limitations of the yagi antenna. In fact, 10 to 13dB of gain can be easily obtained with some designs requiring only simple materials found in the average hardware store. Some of these can be easily built and tested within a few hours—and work quite well for ATV.

The cantenna

The circular waveguide antenna is commonly known as the cantenna among ATV enthusiasts. Its theory of operation is based on the properties of waveguides. In proper-sized waveguides, RF inserted into the waveguide will be propagated within the waveguide with very little loss. At the exit of the waveguide, the wave will exit at an angle that is inversely proportional to the length of the waveguide; the longer the waveguide, the narrower the beamwidth of the radiation pattern. Dimensions of the waveguide antenna are not critical, and feeding the antenna is very simple. **Fig. 3** shows the design of a simple waveguide antenna that can be made out of household materials, such as coffee cans. The diameter of the coffee can needs to be between 0.7 and 0.8 wavelengths in size, and the acceptable range in diameters and inches for the different frequencies for ATV are shown in **Table 1**.

The waveguide is excited with a quarter-wavelength stub inside the can placed a quarter-wavelength from the closed end of the antenna. The length of the antenna should be anywhere from two to five wavelengths, with the longer lengths producing greater gain. Beyond a certain length of the antenna, the gain will flatten out for the classic coffee can cantenna.

Circular Waveguide Dish Feeds	
Frequency (MHz)	Inside Diameter Circular Waveguide Range (inches)
915	8.52 - 9.84
1296	6.02 - 6.94
2304	3.39 - 3.91
3400	2.29 - 2.65
5800	1.34 - 1.55
10,250	0.76 - 0.88

Table 1. *Dimensions of circular waveguide antennas for different ATV frequencies (from Ref. 1, Table 5, p. 18-14).*

The cantenna is probably one of the easiest antennas to build, and it will yield anywhere from 8 to 10dB of gain with very little effort. The simplicity of the design, the construction, and the feeding of the radiator makes it a must antenna for all ATV enthusiasts. Familiarity with this design is important because it is often used with higher-gain antennas, such as the parabolas, for feeding RF into the reflector.

The helical antenna

The helical antenna is a loop of wire that is helically wound with a circumference of approximately one wavelength and a reflector added to provide a unidirectional radiation pattern. This design is called the axial mode helix because it radiates most of its energy in the axial direction of the winding, compared to the normal mode which has a smaller diameter winding, and which radiates at a right angle to the winding. The normal mode helix is used in short antennas such as rubber ducky antennas.

The axial mode helix has high gain and is a broadbanded design—a fascinating design because of its properties in creating circular polarized radiation. A typical helix has a bandwidth of 1.8 to 1 so that an antenna designed for 900MHz will easily work at 1.2GHz.

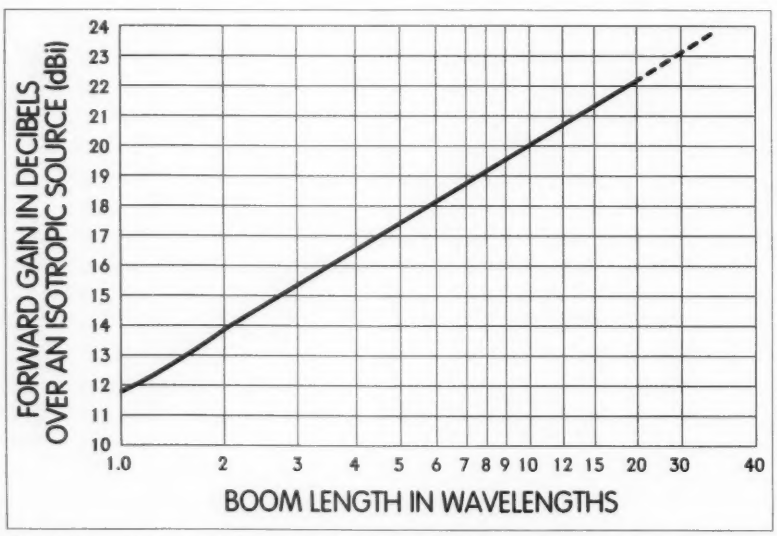

Fig. 2. *Theoretical gain of the yagi as a function of number of elements and the boom length.*

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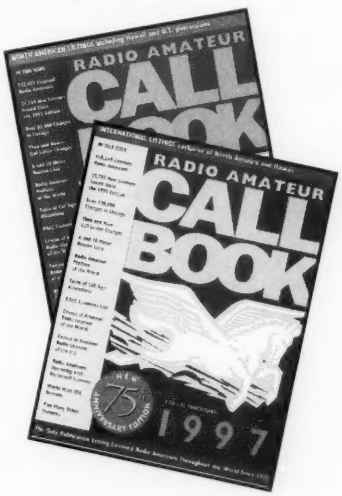

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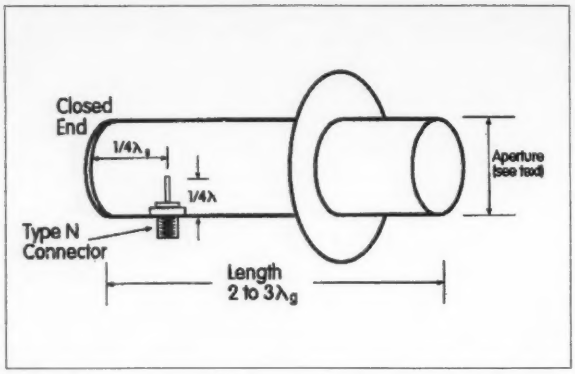

Fig. 3. Circular waveguide antenna (cantenna). The length of the antenna can be increased to 5 wavelengths for higher gain. The disc shown on the antenna is for use when feeding a parabolic reflector.

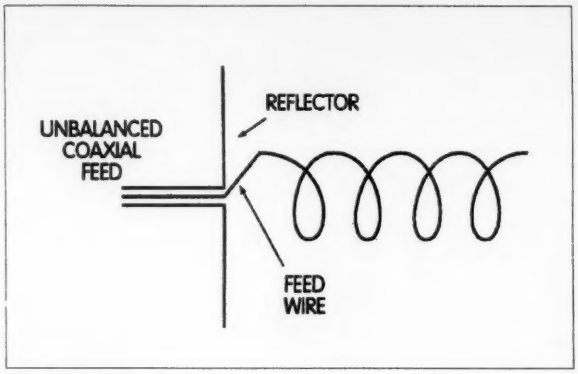

Fig. 4. The helix antenna.

The mechanical layout of the design of a helical antenna is shown in **Fig. 4**. The gain from a typical seven- or eight-turn helical antenna is approximately 12dB, but because of the circular polarization of the antenna, you need to deduct 3dB if you are operating into an ATV antenna, which is either horizontally or vertically polarized. Also, when using the axial mode helix, it is important to choose the correct polarization of the antenna between the right circular and the left circular. A mismatch between the transmitter and receiver polarization will result in almost no gain for the antenna.

The advantages of the helical antenna are that the construction of the design at UHF frequencies is easy and non-critical. This is not true at the lower VHF frequencies, where it becomes difficult to hold the helical windings in place. Another advantage is that the broadbanded nature of the device makes it easy to construct and use. The circular polarization of the antenna is useful where the polarization can fluctuate—as in satellite, balloon, or mobile transmission. The major disadvantage is the higher-than-normal feedpoint impedance, which requires a little bit of matching for 50Ω operation. A winding of one wavelength in circumference, which is what is normally recommended for this antenna, will have a feedpoint impedance of approximately 140Ω and will change as a function of the frequency. Therefore, the operation of this antenna into 50Ω will require some form of matching to the 140Ω, such as a quarter wave of 90Ω transmission line.

The yagi, cantenna, and helical are three antenna styles that are high in gain, easy to build, and a must for the ATV enthusiast. Next time, we'll cover more ways to get the most gain from your ATV antenna system.

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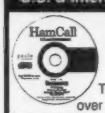

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NEVER SAY DIE

Continued from page 26

layer peril and the terrible contribution to it by man's CFCs from Freon™, hair spray, and so on. It turns out that most of the chlorine getting into the air comes from ocean spray, with a minor amount coming from volcanoes. Man's contribution, it turns out, amounts to 0.000015 percent. Which backs up my April editorial comment about DuPont™ paying off environmentalists to ban the use of Freon once their patent was running out, a shrewd political move which has cost us consumers (the suckers) hundreds of billions of dollars. Was that you out there screaming for Congress to ban CFCs? And did you drive to school in a panic to grab that Alar™-sprayed apple from your child?

If you keep re-electing your congressmen nothing is going to change. Give 'em all one term and out. Let's do away with those re-election campaigns and the bribery they foment. We've tried using professional politicians and look at the mess we're in, so let's start electing amateurs. Non-lawyers, if at all possible.

Tandy™ Shakeup

Thanks Rick KA5PVT, for the newspaper clipping about a major Tandy shareholder asking the board of directors to replace John Roach. Far's I'm concerned the Tandy board has to have been asleep for the last 15 years or they'd have canned Roach long ago. 15 years ago Radio Shack™ had 40% of the personal computer market. Then along came IBM and RS sales plunged to around 4%.

How'd IBM pull a coup like that? By doing exactly what I recommended Roach do with the TRS-80 computers. It was bad enough when I personally tried to convince Roach to open the TRS-80 operating system up. But when he refused to budge, I made the same recommendation in an editorial in *80-Micro*, along with a prediction that if he didn't, the TRS-80 could get blown away.

Since one of the key developers of the IBM PC system was a ham with whom I'd

gone on a DXpedition to Navassa (KC4DX), I had more than an inkling of the IBM plan.

As the editor and publisher of *80-Micro*, which was running around 600 pages a month (the third largest magazine in the country), I had refused to let Radio Shack advertise in my magazine devoted to the TRS-80 because I felt that Roach's marketing policies were too destructive.

The Last *Callbook*

The 1997 North American edition has 2,219 pages, is two and a half inches thick, weighs in at about five pounds, and costs $40. Better get one, since this is the end of the line—the last *Callbook* they're going to publish in book form. From now on it's only going to be on CD-ROM, which, as far as I'm concerned, is a royal pain in the ass. I want a *Callbook* in my office so I can look up ham addresses. I also frequently need it in the hamshack across the road. I can take it to where I need it, whether it's to the typewriter for addressing an envelope, to my computer to put an address into my frequently used address file, or wherever. Even a five-pound book I can move to where I need it. A CD-ROM version is rooted to my computer and takes a lot longer to use.

Similarly, I have a nice dictionary built into my Word program, but most of the time it's faster to grab the *Funk & Wagnall's* off the shelf.

My ROM drive is usually kept loaded with my PhoneDisc so I can look up phone numbers and addresses. That's turned out to be very handy. So, unless you have a computer set up near your rig, you'd better grab a 1997 *Callbook* printed version while they last.

Business Incubation

A report in the April issue of *Dividends*, the Staples™ magazine for small businesses, shows that the success rate for new businesses started in incubators is 80-90%, according to the Ohio-based National Business Incubation Association. Compared to the normal success rate after five years of around 10%, this is a powerful recommendation for business incubators.

Several years ago I was approached by the School of Management at Rensselaer Polytechnic Institute to help them reorganize their curriculum. This resulted in my becoming a member of the RPI Council, the Steering Committee, and their first Executive in Residence. Soon I was consulting for the president, which resulted in the founding of two entrepreneurially-oriented new schools at the university. My consulting for their business incubator project resulted in their making some major changes, with their winning the prize last year as the best incubator in the country.

What I'm proposing is a way for any small town or community to set up a small business incubator and start growing new businesses. As our big businesses downsize and

Continued on page 85

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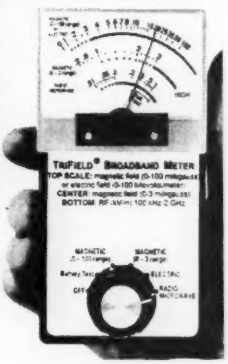

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Home-brew Yagis For Amateur Television

Easy to build, easy to use—and not just for beginners!

Ed Manuel N5EM
10430 Sagevale
Houston TX 77089

When the Houston Amateur Television Society (HATS) began to promote amateur television in our metropolitan area, the first order of business was to get people watching the ATV repeater. It's hard to get someone interested without seeing activity. Our repeater uses 421.25MHz (conveniently, cable television channel 57), so just about everyone has an ATV receiver already. All that is needed is an antenna.

Almost everyone who has a television, also has an antenna. Unfortunately, 421.25MHz is far enough from UHF channel 14 (480MHz) that most commercial television antennas we have tried perform poorly unless the station is close to the repeater. Unless you live in a small area, you almost never get to point your antenna at the commercial TV stations and at the ATV repeater at the same time. One amateur in Houston actually lives close enough to the repeater to watch ATV with rabbit ears—but this is the exception.

***Photo A.** The author, Ed Manuel N5EM, holds a 70cm ATV yagi and 1.2GHz yagi still under development. Activity in the background is a North Texas Microwave Society antenna measuring party.*

For most of us, an antenna specially tuned for the ATV repeater is a better choice.

A couple years ago I attended the Dallas Hamfest. A friend of mine (Kent Britain WA5VJB) was presenting an article on his latest microwave development—a series of antennas for 2m through 23cm, for use with a rover station during microwave contests. Kent is aware of many other VHF/UHF pursuits besides small signal contesting, and has created designs for amateur satellite work, FM repeater work and amateur television. My attention was immediately captured.

It soon became apparent that we had struck gold with Kent's design. In the two years since making the first antenna, we have distributed more than 100 of these as kits or finished antennas in the Houston area. They have proved to be easily reproducible and reliable. Many of them have been handed to new amateurs who have never built anything. Some hams were so new to amateur radio that they had only been active in two meters with hand-held radios. No one has ever tried to get one of these antennas working and *failed*.

Many hams have been taught that yagis are nearly impossible to build properly. In every case, the problems can be traced to the builder's failure to construct the antenna exactly as described. In order to make our antenna design reproducible, we decided to package them as kits. The kit solves many problems. By providing all the elements and a pre-drilled boom, along with a properly terminated coaxial pigtail, success is assured.

Kent's antenna is a marvel of simplicity. He created a design that keeps the element lengths in even fractional-inch dimensions so one can measure them accurately with a simple ruler.

Materials include wooden booms and brass welding rod elements. The driven element is a J-shaped rod that resembles a J-pole antenna. By using a simple driven element and adjusting the spacing of the reflector and first director, Kent managed to make the feedpoint impedance of the driven element match the desired feedline impedance without an adjustable match. This removes the greatest challenge for the inexperienced builder. A typical 421.25MHz receiving antenna is very difficult to adjust by normal methods. Most hams don't have a 421.25MHz transmitter with a 75Ω output and 75Ω SWR bridge—but all one has to do is adhere to the design and the match is so close no adjustments are needed.

Construction is simple

Start by buying good quality one-by-twos or one-by-threes (I prefer poplar

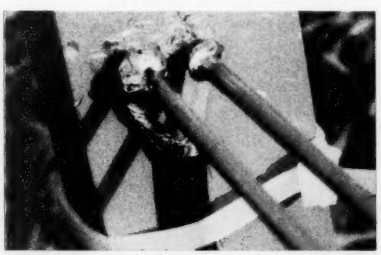

***Photo B.** Close-up of the yagi feedpoint. The shield goes to the half-wave portion of the driven element, while the center conductor goes to the quarter-wave portion. Note the thicker area of the boom.*

with oak as a second choice), and rip them into square booms, 3/4-inch x 3/4-inch by six feet long. If you don't have a table saw, just ask around on the local VHF-FM repeater. A short section of the boom is cut off and glued to the back of the boom (**Fig. 1**). This double-wide section does two things: It provides a larger area for mounting a U-bolt and it provides some additional boom width for the driven element. The J section is a bit wide for the 3/4-inch boom. After measuring the hole spacing along the boom and drilling the holes (1/8-inch for the welding rod), the boom is ready and can be put aside.

It takes about 15 minutes to cut out the brass rod elements. (See **Table 1** for dimensions and spacing information.) There is some waste since brass welding rod typically comes in 36-inch lengths. The best method is to cut the longest rods first (reflector end of the antenna). After each cut, measure the leftover piece and compare it with the shorter lengths required. If you need to make other antennas for higher bands (smaller elements), then you don't have *waste*, you have extra material.

Clean up the ends of the elements with a file and insert them into the boom according to length. They go longest to shortest from rear to front. Center them with a ruler. When you like the placement of all elements, put the antenna into a vise and put a drop of glue or cement on each element where it enters the boom. I like to use a thick cyano-acrylic glue (SuperGlue™) that is sold in model shops. It is available in a quick-drying formula that makes it easy to work with. You could also use epoxy cement. When the glue or epoxy is set, turn the beam over and do the other side. Leave the antenna overnight until the glue is completely dry.

Now attach the feedline. This is a 75Ω antenna, designed to feed the 75Ω input of your television. The pigtail is a short length of RG-59, RG-6 or other 75Ω cable. Solder this cable to the feedpoint. Look for cable with a copper or tinned (solderable) braid. It's not possible to attach the aluminum foil-shielded types of cable to the driven element. One type of cable I prefer is a 75Ω Teflon™ type used in air plenums in office buildings. This cable has a Teflon outer jacket and inner dielectric. The braid is made from copper wire and the center conductor is copper plated steel. The Teflon is impossible to melt, which is a boon in soldering to the 1/8-inch brass welding rod. One local antenna builder buys regular RG-59 cable at Radio Shack®. Careful soldering avoids the need for Teflon, but it's not easy. Pre-tinning the brass rod at the points of attachment makes this process easier.

Terminate the pigtails in a standard "F" connector (crimp type). This makes it ready to connect to an "F" type barrel for connection to your feedline or allows easy insertion of a TV type preamp if needed. If you want to build your preamp, the ATVers in Atlanta published a neat design (see Bill Brown WB8ELK's "ATV" column, *73*, September 1994).

The builder must give careful thought to weatherproofing these antennas. The

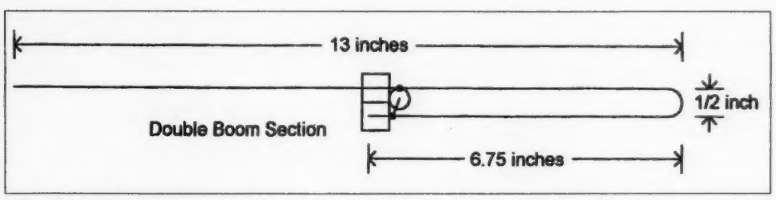

***Fig. 1.** Specs for a driven element.*

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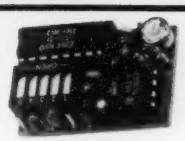

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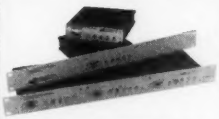

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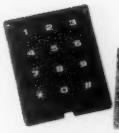

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boom is wood and will absorb water, ultimately warping. Some builders use two or three coats of quality outdoor varnish, followed by two coats of an outdoor lead-free enamel (stealth gray, of course). The feedpoint should be given several coats of clear paint (RustOleum™) to keep the solder from weathering. The connectors are not weatherproof and must be protected as any other connector. Use some good product like Coax-Seal™ or RTV™ (non-corrosive electronic type).

As with other UHF antennas, the higher this antenna is mounted, the better—with one caution: There is no need to get the antenna higher than absolutely necessary. If you get perfect reception at 35 feet but have a 90-foot tower, resist the urge to go to the top. That additional feedline to get to the top has loss. It is quite possible to lose signal by having more feedline loss than you would have if you mounted it just high enough to clear local clutter and vegetation. Since this antenna is designed to be rear-mounted, it is perfect for mounting on a tower leg and pointing (permanently) at the ATV repeater. Remember that this antenna is designed for 421.25MHz. That's a repeater output frequency and is rarely used for point-to-point operation. If you want to chase DX to distant repeaters you might want to mount the antenna on a rotatable mast. If you find you need a very long feedline, you should consider using RG-11 instead of the smaller, more lossy cables. You might also find you can get 75Ω hard line used to build cable television systems from your local cable TV company for free. Any length less than several hundred feet is scrap to a cable company. Connectors are a bit difficult to obtain, but are not that difficult to make.

If this antenna is not big enough for your location, there are other options. You could get a commercial antenna, like the M2 440-21 ATV. This antenna is over 14 feet long and is one of the largest commercial ATV antennas available. An alternative to purchasing a commercial antenna is to phase an array of two or four of these home-brew yagis. Two will provide almost 3dB of additional gain. Four will provide almost 6dB more gain. The stacking distance is a modest 28 inches and an array of four is not impractical.

Phasing multiple antennas

For 70cm, remember that we are dealing with 75Ω antennas. In Houston we have chosen to parallel two antennas with an F-type tee. The resultant impedance is now 37.5Ω. At this point, a quarter-wave transformer of 50Ω cable brings the impedance up to 75Ω again. If you want to phase four together, you simply do this twice. The recommended stacking distance is 28 inches, which makes a nice, compact array. If you make your 75Ω pigtail from the antenna 20 inches long (approximately 19 inches after you strip and attach it to the driven element), you will have a perfect length to reach the tee. You can find RG-58 cable with a solid center conductor which can be terminated in F connectors. We currently have a couple of dual antenna arrays in Houston (and plans to build a quad array).

One last note about stacking is: When viewed from either the front or rear, your driven elements should appear identical. The J driven element we are using has a long side, a short side and a folded end. Each part of the element should be positioned exactly as every other element. If you inadvertently flip one, you will have it out of phase with the rest of the array. Double-check to make sure that you are feeding the end of the short side and have attached the shield of the coax to the center of the long side. These little things can really mess up the pattern and performance, and are hard to fix after putting the array in its final mounting position.

Your antennas should match the polarization of your ATV repeater. In Houston, we use horizontal polarization on 70cm and vertical on all other bands. Of course, that is always subject to local decision and changing RF environments.

There are certainly other antennas that can be used for ATV. The yagi described here is just one approach. We have found it to be easy to build and very effective—great for the new ATVer.

Additional documentation on the antennas is readily available to those who wish to make one for other bands. You can make a call from a FAX machine to our fax-back server in Houston. Just call (713) HOT-FMTV and follow the instructions to get the antenna documents, which include designs for every band from two meters to 23cm.

I strongly encourage ATV clubs to consider making kits like this available to hams in their communities. If you want to promote ATV, it's easier to hand someone a kit and show him how to make it work, than it is to *tell* him how and expect him to do it. We have sold these kits in the Houston area for $15. You could build them for about $10 but you would have to gather all the pieces. Many people would like to have ATV receive capability but will never get around to it. Put a kit in their hands. Get them receiving the local activity and they will get interested in a hurry—at least, they will if your ATV activity is interesting—but that's another article. 73

70cm Yagi for 421.25 MHz (75Ω Feedpoint Impedance)

Element	Length	Location
Reflector	14.00	0.00
Driven Element	13.00	3.00
Director 1	12.50	6.50
Director 2	12.25	12.25
Director 3	12.25	17.75
Director 4	12.00	24.50
Director 5	12.00	30.50
Director 6	12.00	36.00
Director 7	11.75	43.00
Director 8	11.75	50.25
Director 9	11.50	57.25

Note: If rear mounting is desired, space must be left behind the reflector.
All dimensions are in inches.

Table 1. *Dimensions and spacing for the elements.*

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Pushing the edge

We have a group within the Houston Amateur Television Society, Inc. (HATS), that is constantly looking for new and interesting ways to use ATV. We are the "toy" group: those who are looking for strange and exotic video viewpoints. I've been flying model rockets since the late '60s but had grown away from it during college. About four years ago a long-time friend invited me to one of the South Texas Balloon Launch Team meetings and introduced me to HATS. Several members were getting into the next level of rocketry—amateur rockets. They had outgrown the smaller Estes rockets and were reaching for the stars—or parts of the upper atmosphere. I went to a couple of the rocket launches, scheduled events requiring FAA flight clearances, and met someone I recognized. It was my family physician, a licensed manufacturer of Aerotech™ reloadable rocket engines under the "Dr. Rocket, Inc." name. He was fascinated by amateur television, and was interested in using it in rockets to record the flight and aid in recovery.

Early attempts at ATV were cumbersome, and not too impressive. A guy flying his 8mm camcorder had much better video... until the flight when the parachute didn't open and the camera recorded six inches into the ground. With newer equipment and smaller cameras now available, a more robust ATV system can be flown. It still costs as much as a good camcorder but allows instantaneous viewing, doesn't suffer from the tape being pulled away from the recording heads by G force, and allows the recording of a flight where a tape system would destroy itself *and* the tape.

This system is being designed for a rocket with an outside diameter of 98mm, about 3.9 inches. To balance the engine system, the rocket and electronics must weigh almost 15 pounds. The engine system is a reloadable "N" motor.

If you launched rockets as a kid, you probably used B4-2, C6-5 and D12-7. This alphanumeric naming has some forethought to it. For every increase in letter designation, the power of the engine doubles. Two "Bs" equal one "C", two "Cs" equal one "D"... which makes an "N" motor roughly equivalent to 2Ms = 4Ls = 8Ks = 16Js = 32Is = 64Hs = 128Gs = 256Fs = 512Es = 1024Ds = 2048Cs. This is not something you buy at the local hobby shop! One of the requirements for purchasing motors of this class is membership in a recognized amateur rocketry organization and successful flight demonstrations to flight observers certified in the motor classifications of intended use.

A reloadable motor has a higher initial cost than a single-use engine but also has the advantage of being reusable—similar to the space shuttle's solid fuel boosters without the O-rings. Our rocket is projected to fly to 30,000 feet at a speed of more than Mach 1.6 (about 1,100 miles per hour).

The plan

We wanted to create a system where as much information as possible about the flight was sent to the ground fast enough to provide time to react to problems (the nose didn't separate; the main parachute didn't deploy), so we could send a ground command to correct the errant system. To accomplish this, we have two microcontrollers, with sensors for G-force, velocity, temperature, and absolute pressure, in conjunction with two video cameras providing a view

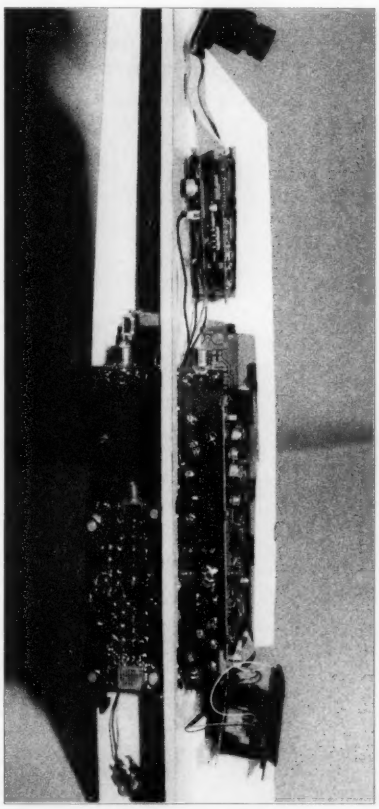

***Photo A.** Mockup of nose cone with cameras and transmitters approximately positioned.*

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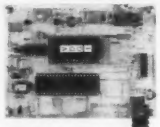

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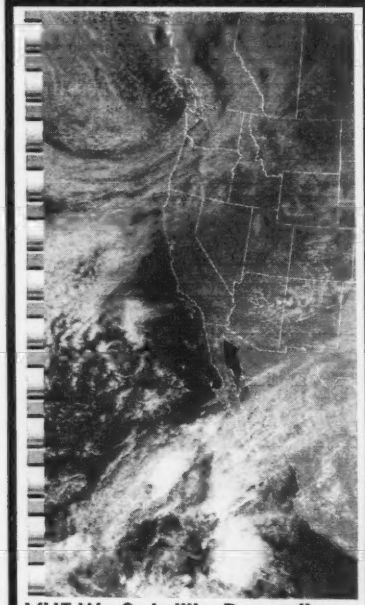

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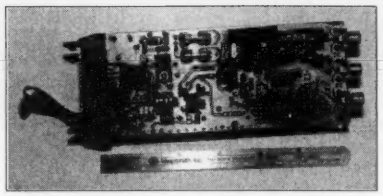

***Photo B.** Delta prototype transmitter with one audio channel installed.*

straight out from the rocket (the horizon camera), and another looking down and along the rocket (the "been there" camera). The horizon camera will display sensor information using a two-line video title chip fed by one of the controllers. Both cameras feed separate transmitters (one with audio to hear the BOOM) and then combine at the high power amplifier to be transmitted through one J-pole antenna.

The body tube diameter (inside diameter of 3.625 inches) was a compelling reason to repackage the Houston Amateur Television Society (HATS) TR1 "Charlie" revision transmitter into a form that could be reshaped based on available space. The Delta transmitter can be separated into three separate modules and positioned as needed to fit small spaces. The Delta modules became small enough to allow the entire video system inside the nose cone. It also helps to have a nose cone almost 4 inches in diameter and 20 inches long! Most model rockets aren't this big!

We had to create a small mixer board that would combine the two video signals and adjust the power level before feeding it into the high power amplifier (HPA). Several ideas were proposed, but the easiest solution won out. We had two 50-ohm signals that we wanted to combine into one 50-ohm output and at the same time cut the power level. A small piece of copperclad, three chip resistors picked by using a neat little program created by Teledyne, and we have a pad to adjust the power level into the high power amplifier. Just what the doctor ordered!

***Photo C.** The view from approximately 3,000 feet. On a very good day with three stages, an Estes Farside™ could get to little more than half this height. (Photos from South Texas Balloon Launch Team's flights.)*

The cameras

The horizon camera used is a color teleconferencing camera made by Intel™. It is a standard output NTSC (RS-170A) unit with resolution of 330-350 lines and amazing light sensitivity (near 1 lux). The camera lost 348 grams with the removal of the swivel base and steel RF shield, to weigh in at 72 grams. One really nice feature of this camera is the power switch. In the original case, opening or closing the lens cover would turn the camera on or off. I can wire the camera so it runs any time power is applied or add a relay to one of the controller boards and control the camera with the microprocessor unit.

The "been there" camera is a high-resolution color board camera from Edmund Scientific™. It has NTSC output, 450 lines of resolution, 5 lux sensitivity, and a 3.8mm f/5 lens. It weighs 68 grams. It is rated for only 6.8G non-operational, so additional work will need to be done to keep this camera in one piece and operating at 10-15G.

The video transmitters

Two Delta transmitter prototypes are being used: one is video only at 1247MHz, and the other has one audio channel at 1255MHz. The VCO sections have been separated and stacked underneath the audio/video section.

Antenna

The first pass antenna is a J-pole driven element from the HATS 20-element yagi for 1.2GHz. A null is expected to appear as the rocket gains altitude. We will compensate for this by having the receivers positioned about one mile from the launch site. Depending on how much this null interferes with reception, we may need to use a quarter-wave stub under a ground plane to reflect the signal down toward the ground. The stub-under-ground has worked well for South Texas Balloon flights but does require

***Photo D.** The halfway point for a normal flight, 18,000 feet.*

that the antenna remain in a more or less vertical orientation.

Controller board

The controller has yet to be finalized (at this writing). The microcontroller (MPU) is a Microchip PIC14000 which contains 7 A/D channels with 10-16 bit resolution, an internal temperature sensor, internal watchdog timer, and up to 20 I/O pins for digital controls. Pressure sensors consist of a Motorola MPX5100A absolute pressure sensor and a Motorola MPX5500DP differential pressure sensor. The absolute pressure sensors will be used to calculate approximate altitude while the differential sensors will provide velocity data. A Motorola MMAS40G10D accelerometer chip (0-40G) will provide acceleration rate information. The MPU will use its internal time of flight counter, altitude data, velocity and acceleration to determine where it is in the projected flight path. This information will determine when the rocket will separate at apogee (maximum height) and when the main chute will deploy at approximately 2,000 feet above the launch site. This information will also be displayed on the horizon video channel using an NEC uPD6450 video titler chip.

***Photo E.** The Gulf of Mexico is visible from 30,000 feet, the projected range of the author's project rocket.*

Nose cone

The nose cone itself is 19.375 inches long, 3.875 inches in diameter. An additional 12 inches of length will be added to the nose cone for ballast and batteries. It is being constructed using E-Glass™, an aerospace application Fiberglas™ reinforcement, and five-ounce Kevlar® in the structural reinforcement areas. Lexan® "windows" will be molded into the glass reinforcement.

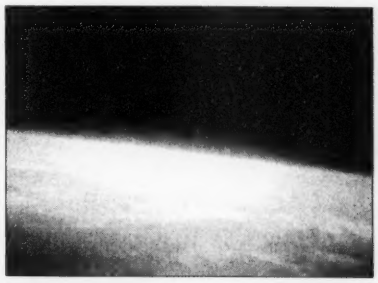

***Photo F.** Only rockets on steroids get up to 93,000 feet. Barely visible midway across the photo is probably Venus or Mars.*

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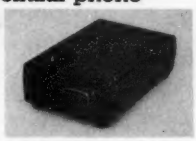

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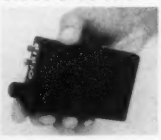

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Marshall G. Emm AAØXI/VK5FN
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E-mail: [aaØxi@mtechnologies.com]

For several reasons, I have always been skeptical of automatic tuners. First, for the most part they are very limited in the degree of mismatch that they will handle. Second, they mostly "go with" an expensive transceiver they have been specifically designed for. Third, and most important, they have been extremely expensive, especially for something that is usually a ham's first home-brew project—made out of old radio parts and junk.

The AT-11 is relatively inexpensive, it works well, and it will work with any transceiver—just hook it up in your shack in place of your existing manual tuner, connect 12V, and you can almost forget it's there. The AT-11 was originally published about 18 months ago as a *QST* project, and is now available in two separate versions—a QRP version, and the QRO version (which I built for this review). Either version can be purchased with or without a nicely laid out enclosure. The QRP version is small enough to fit *inside* some QRP transceivers; the optional enclosure for the QRO version is only 6.5 x 8.5 x 2.5 inches. That makes it very attractive for mobile use.

How it works

The AT-11 uses 17 relays to switch between combinations of eight fixed inductances and eight fixed capacitances in either a low- or high-impedance configuration (the capacitance is switched to either precede or follow the inductance in a traditional L configuration). Thus there are 256 inductance combinations possible, and 256 capacitance combinations possible in either high- or low-impedance configuration, for a grand total of over a quarter million tuning combinations. The AT-11 uses its microprocessor to set combinations of inductance and capacitance, and check the SWR with each one, until a suitable match is found. Depending on how many combinations are tried, the unit will require from one-tenth of a second to 6.2 seconds to either find the match or indicate that one can't be found. The current SWR reading is indicated by three LEDs: green, 1.5:1 or better; yellow, 2:1 or better; and red, greater than 3:1. The intermediate ranges of 1.5-2 and 2.5-3 are indicated by lighting two adjacent LEDs. So, for example, if both the yellow and red LEDs are lit, you will know that the SWR is between 2.5:1 and 3:1. A fourth LED indicates that tuning is in progress. After tuning, the AT-11 "goes to sleep" so that stray hash from the processor doesn't interfere with reception.

The AT-11 has two modes of operation—automatic or semi-automatic. In fully automatic mode, the tuner "wakes up" when you transmit, monitors the SWR, and immediately attempts a rematch if the SWR increases to more than 3:1. In semi-automatic mode, you can push a button to make the AT-11 go into the tuning algorithm at any time. In either automatic or semi-automatic mode, you can use four buttons on the front panel to increase or decrease either inductance or capacitance by one step at a time. This last feature is particularly useful because in seeking a match the AT-11 will stop if it finds one with a resulting SWR of 1.5:1 or better. Thus, the tuner may stop with a 1.5:1 match in situations where a closer match can be attained; you may be able to get it closer to 1.0:1 by nudging the buttons. I know, the textbooks say that for all practical purposes you might as well leave it at 1.5 to 1. With QRP gear, however, the heat generated by an SWR of 1.5:1 in the final transistor can be harmful—and it is often *fatal* (to your final, that is) to operate these rigs with an SWR of 2 to 1!

Another aspect of the tuner that I should mention is power handling. The QRO version of the tuner is spec'd at 100W but will in fact handle about 150W on a 50% duty cycle (e.g., CW and SSB). When tuning, of course, there can be combinations which result in high voltages on the relay contacts and stray RF around the circuit board, so

***Photo A.** The AT-11 Automatic Tuner is ready to go.*

LDG recommends tuning with 10W or less—the AT-11 will respond with as little as 2W of applied RF.

Construction

In some respects the AT-11 is very easy to build but it can be frustrating because of discrepancies between the silkscreen overlay on the board, the overlay diagram, the parts list, and the schematic. Most such problems should be rectified by the time this review sees print, so keep in mind that the comments were based on the version current when I built it.

An experienced builder will require five or six hours to complete the kit—there are over 200 components and 500 solder joints, so do take your time!

The kit will require a high level of soldering skill—many of the tracks are quite close and the components are small. For example, the 1/8W resistors are about half the size of those most of us are used to working with, and the processor chip socket has 52 connections. An added complexity is the addition of five components on the foil side of the processor socket—these are extremely close solder pads and in one case you need to tack the leads from three components to a single pad.

There is a reasonably complex bifilar transformer, and eight toroidal inductors to wind. The instructions are clear, and only the transformer is really challenging. The eight toroids are quite large, as is the wire, so you should have no difficulty if you follow the instructions. An easy mistake, though, is to wind in the wrong direction, in which case the resulting coils will not fit properly on the board and you will have to do them over. The transformer is a little more difficult, but certainly not beyond average skills. Note that it is mounted flat to the board, though, or you will have difficulty running the antenna input wire through the middle of it!

Apart from the winding of toroids, the instructions are somewhat rudimentary, and you will be well advised to read through the entire manual before touching the board with a soldering iron.

First, as is my normal practice, I soldered in the IC socket, and I suggest that any builder should start with that. The first soldering instruction in the manual is: "Parts are installed and soldered in order of height, from shortest to tallest. With the PC board blank, it is easiest to install all of the resistors first." The problem with that is that a number of the resistors share a solder pad with another component (e.g., 18 or more transistors) and if you aren't extremely careful you will occasionally fill the other hole with solder. It's fairly easy to identify those situations as you go and postpone the resistor until you do the other component, but the point is that you don't always *have* to follow the instructions step-by-step, and in this case it might be a good idea to exercise a little discretion. Ticking the components off on the overlay diagram as you install them is a good way to keep track.

There was a problem mounting the ribbon cable connector on the board—it may be rectified by the time you read this, but the pins are too big for the holes. The solder pads are not large enough to drill the holes out, so LDG's recommended solution is to tack-solder the connector to the board and then flow solder through the holes from the other side. The result is quite strong enough, and electrically sound if you have in fact determined that solder has flowed through onto the pins. The one large diode is also too big for its britches, but I found that those holes *could* be drilled out enough to make it fit. If you don't have a small enough drill, you can of course solder the diode to the top of the board.

Two of the .01 caps turned out to be "ring-ins." I had *three* left over when I thought I was finished, so I did a comparison between the schematic, the parts list, and the parts overlay. The parts list accounted for 53; add two (which don't have C numbers) for the processor mod and that makes 55, or one left over. I checked them off one by one and discovered that not only had I not installed C67 and C70, I couldn't figure out where they were supposed to go. According to the schematic they should be located near the power switch, but everything in that part of the board was accounted for. Eventually I had to contact LDG for clarification, and was informed that (a) there was an extra cap supplied, and (b) C67 and 70 had been deleted from the power input and "relocated" near relays 8 and 17. Sure enough, they do appear on the parts overlay diagram and there are holes on the board for them. I'd missed them because with that one exception the parts lineup for each relay is identical. By the way, LDG's support, in the person of Dwayne Kincaid WD8OYG himself, was fast and courteous. Help *will* be available if and when you need it.

The smoke test

Once the board is complete, you are instructed to connect power and check a couple of voltages and current before inserting the CPU chip. The only trap here is that if you have been following the instructions exactly, you will have mounted the power jack on the circuit board, but you haven't yet connected the switch—to apply voltage to the circuit you need to either hook up the power switch or apply the supply voltage to the hot side of the switch pads on the board.

The next step is to install the board in the (optional) enclosure, wire up offboard connections, and insert the CPU chip (using standard anti-static precautions, of course). The panel wiring is straightforward, as long as you are very careful with the ribbon cable. I made a mistake and cut one lead to the wrong length, so I had to repair it. When I'd finished the wiring, it seemed sensible to create another testing stage and repeat the power-on checks before inserting the CPU chip, and the clacking of a relay told me that I had indeed been wise. One of the tacked-on components on the bottom of the board had been pressed against another pin on the CPU socket.

Calibration has a catch to it, too. It should be very easy, since all you are doing is setting the pickup voltage level for the SWR circuit and balancing the forward and reverse detection circuits, but the instructions have R53 and R54 reversed. Fortunately, common sense says that when you are measuring the forward voltage you adjust the trimpot labeled "fwd," not "rev." And *experience* says that if you use the R numbers in the manual you will not align your tuner, period. Once the unit is aligned and you are ready to test it, you are in for something of a shock. Push the tune button and you will think you are about to be bitten by a rattlesnake—it sounds as if all the relays are spazzing out, but it turns out that what you are hearing is perfectly normal. You get used to it

quickly and then you will be impressed with what the unit is actually doing.

The AT-11 in operation

This is a nice device to use; it's fast, precise, and reliable. There are finite limits to the degree of mismatch that it will tune, but in practice I suspect that an antenna that can't be matched with the AT-11 isn't going to be much use as an antenna anyhow. Sure, with the right combination of added inductance and capacitance you can "match" a piece of concrete—that doesn't make it a good antenna! In any case, it's probably fair to say that the AT-11 is more versatile than it looks. There is only a single SO-239 coax jack for the antenna output, but that does not mean it will only tune antennas fed with 50Ω coax. If you open up a tuner that has outputs for balanced transmission line and single wire, what do you find? The single wire connection is just connected to the coax jack, and the balanced line terminals are connected to a balun. It's very easy to turn a PL-259 coax plug into a connector for a single wire, and you can always add an external balun either at the back of the tuner, at one of the outputs of a following coax switch, or even outside your shack.

The AAØXI antenna farm consists of a weedy crop of miscellaneous skyhooks, including an R7 vertical, resonant dipoles for 30 and 40 meters, and a shortened all-band doublet fed with 450Ω ladder line. The AT-11 tuned everything perfectly, insofar as it found a better than 1.5:1 match on all the bands I use, with the antennas I normally use for those bands. It also gave me a good match for the R7 on 80m and matched the two dipoles *and* the vertical on six meters!

One minor drawback in shack operation is that the AT-11 will not preserve settings with the power off. That's just a fact of life when you use relays, which after all made the project a lot more feasible, and affordable, than one using motor-driven roller inductors and vacuum variables. And the AT-11 does take some power to run. Momentarily during tuning it is possible for all of the relays to be energized at once, resulting in a current drain of half an amp. A more typical load is 200mA average.

The AT-11 was not the easiest kit I have ever built, but over time I believe it will prove to be exceptional value for money—especially if it performs as well in a mobile or portable environment as it does in the shack.

The LDG AT-11 Automatic Antenna Tuner kit is supplied in several different combinations of board kit, enclosure, QRP/QRO version, factory assembled... too many variations to list here, so contact LDG or check their Web site to see what's available and current pricing. LDG Electronics, 1445 Parran Road, St. Leonard MD 20685. Phone, (410) 586-2177; FAX, (410) 586-8475; E-mail, [ldg@radix.net]; or check the Web site at [http://www.radix.net/~ldg]. 73

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I never could pass up a challenge. While my brother and I live in the same state, we are still 400 miles apart. During a recent visit a bit of reminiscing was in order. As children we enjoyed building model rockets. This led to him saying, "Since passing 40, I am now allowed some 'middle age crazy.' The kids and I have gone back to building rockets. Why don't you use your ham radio stuff to build us a payload?" I told him that I thought I could build an amateur TV (ATV) payload if he could give me eight ounces of net weight.

The challenge

This weight would give him a real challenge. Neither of us like the idea of a multiple-engine craft because it is difficult to guarantee simultaneous ignition of the engines. If only one lights you can easily create a "land shark." This is not a pretty thought, especially with a couple of hundred dollars worth of ATV gear in the nose!

Fig. 1 shows the block diagram for the ATV system. As it turned out, the transmitter and camera portions were easy to build. Commercial kits are now small enough to handle these tasks and are reasonably priced. The most unglamorous part became the challenge. To power the CCD camera and a one-watt transmitter about six to seven watts of power supply capability with at least a dual voltage output would be needed. All this had to work from the lightest, most inexpensive batteries available, which led to the following design specifications:

Input	4.5 volts minimum, 12.6 volts maximum
Output	13.8 volts regulated at 300 - 400 mA, plus 9 volts regulated at about 100 mA
Ripple	as low as possible, preferably below 1%
Battery	0.5 to 1 Ah (amp-hour) with a maximum weight of 3 oz.
Power supply weight	less than 1 oz.

A close review of the *Enercel® Battery Guidebook* showed that while lithium batteries have the highest energy density (i.e., most Ah for the least weight) their cost would be prohibitive, at about $11 each. The two remaining choices with high enough maximum current output were alkaline and NiCd. The problem with either of these was getting enough cells stacked for a manageable voltage boost without falling out of the range that an inexpensive regulator could handle. As you will see later the power supply performs flawlessly, but battery weight is still a challenge for the rocket system.

Circuit description

Old-style linear power supply design was as solid and smooth as a diesel engine, and almost as heavy—our new project called for a supercharged high-rpm aluminum race engine. The switching power supply fits this analogy very well. Several years ago they were as complicated to design and use as a race engine. However, technology has advanced rapidly and National Semiconductor™ makes a line of integrated circuits called Simple Switchers®. I looked carefully over their product line with a supplier catalog close at hand, and found the LM2577-ADJ series fit my requirements nicely. The part was small, readily available, and reasonably priced in single quantities from Digi-Key™.

The design process begins with the data sheet. The data sheet circuit proved to be effective in its simplest form. **Fig. 2**, my project's circuit, uses this form with a secondary voltage regulator. The figure also shows component values needed to meet my requirements. The equations to calculate the specific values are not complicated, but they are a bit tedious. National provides design software from their Web site at the URL (Universal Resource Locator) [http://www.national.com/design/index.html], which will save you the drudgery. The program is MS-DOS based, but is solid and robust. Alternately, the equations from the data sheet could be placed into a spreadsheet with the same results. It is very helpful to use one of these computer-assisted methods since several cycles through the calculations are needed to find the optimal balance between weight (e.g., will a heat sink be required?), component size, input voltage range, and ripple.

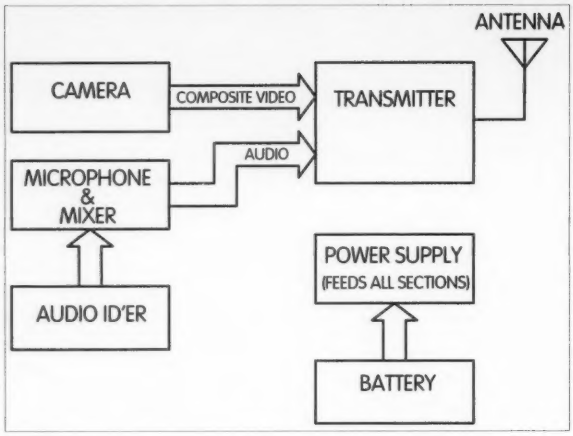

Fig. 1. *Creating an ATV transmitter relies on the power supply.*

The operation of the circuit is straightforward. An internal NPN switching transistor pulls the junction of the inductor and diode to ground, allowing energy to be stored in the inductor. When a maximum current is sensed, the transistor cuts off, allowing the energy to be discharged and stored in the output capacitor. A divider on this output voltage provides the control to adjust the current maximum required to keep the output regulated.

There are some unusual considerations in the components to be considered. First, the current through the inductor is not a steady state value. This means that the instantaneous maximum inductor current and LM2577 current can be about five times the load current. When selecting the coil, this maximum current must be considered to avoid saturation of the coil core and poor regulation. Also, the switching transients are large. This means that the output capacitor must have a low internal series resistance to handle the high frequency part of the filtering job. The program provided by National calls this the E.S.R. Unfortunately, most of the manufacturer's specifications for capacitors defined this in terms of dissipation factor—tan δ. The conversion equation is E.S.R. = tan δ/ωC, where ω takes on its traditional value of 2 x π x f (C is in farads, f is in hertz and E.S.R. is in ohms).

In my system this meant that E.S.R. = tan δ/(2πfC) ≅ tan δ/349. Just be sure to select a capacitor with a tan δ that is as low as possible.

Construction

There are no critical concerns for component layout or construction methodology. During the design of the supply you will need to determine whether a heat sink is necessary for the IC, but other than that, any construction approach should be acceptable. In the case of the supply shown in **Fig. 2**, calculations show no heat sink is required, up to a total current of about 425mA and ambient temperatures below 110°F, but the unit will operate very hot. The junction is rated for operation at 257°F (125°C) and the program designs for this. Case temperatures can easily boil water or burn fingers, so use a heat sink if you have room for one.

The circuit was first constructed and tested using the multicontact solderless breadboard system shown in **Photo A**. Once operational specifications were confirmed, the circuit was reconstructed on a Surfboard™ to keep its size and weight to a minimum. The end result is shown in **Photo B**.

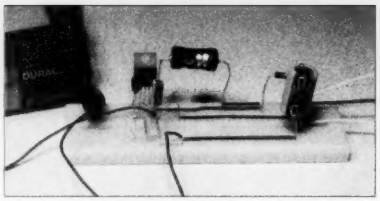

Photo A. *Prototype design is easy on solderless breadboards.*

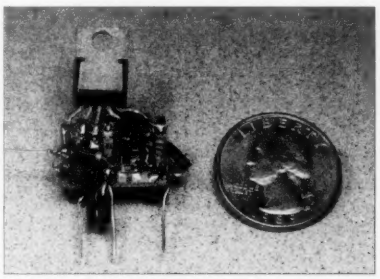

Photo B. *Mission accomplished—seven watts of regulated power the size of a quarter!*

How the circuit was moved to the Surfboard deserves a few comments. Each point of connection on the schematic was labeled with a node letter and then a table was constructed with each node and the components connected to it. Using this table allowed the circuit to be redrawn into a configuration that fit the Surfboard with a minimum number of jumpers; the result is a very compact package, weighing only 1/3 ounce (9.5 grams). The quarter in the photo weighed 1/4 ounce (7 grams).

Testing

Your testing will probably only require basic voltage checks on the output. Just be sure to put a power load resistor on the output so that the supply is at least minimally loaded during testing. I wanted to perform a more thorough test for this project, however—with two objectives: First, it was important to verify that the supply was operating properly and was stable throughout its input operating range. Second, an estimate of battery life was needed.

Fortunately, DMMs have now become

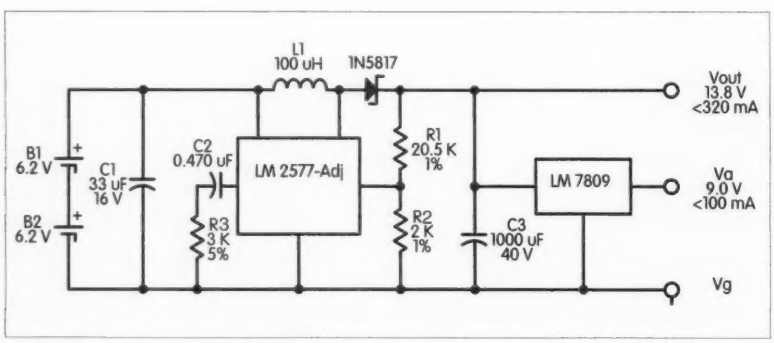

Fig. 2. *Putting it all together into a workable circuit.*

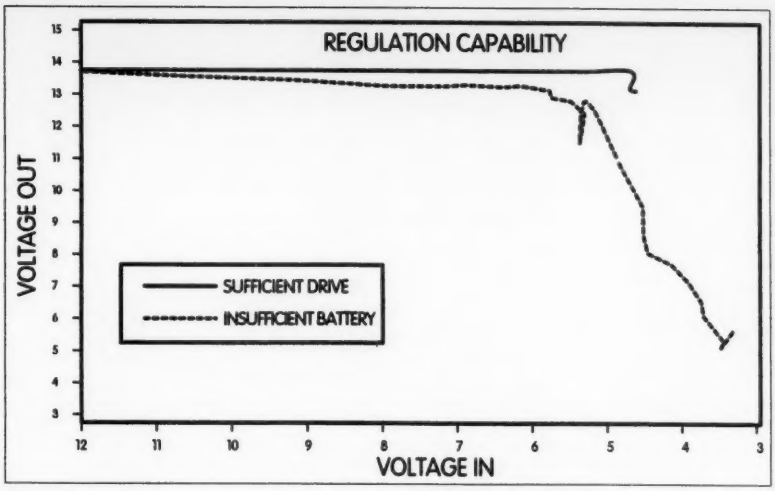

Fig. 3. A good battery is essential, but this little supply can deal with nearly anything.

so inexpensive (under $20 each) that I had enough to monitor input voltage, output voltage, and output current simultaneously. **Fig. 3** shows a plot of input voltage versus output. This was performed with a 100mA load on the 9V output and a 325mA load on the 13.8V output (a total of 425mA on the supply). Input was from two Duracell® size "J" alkaline photo batteries wired in series. You can tell from the curve that things took an unexpected turn at this point. When loaded with a 10% load (35mA), everything operated perfectly. However, with the full load applied, the input current demand was so high that the batteries could not meet the demand. This led to an interesting investigation of batteries (see **Sidebar**). When larger batteries were used, the system worked as desired.

The curves show that the circuit was regulating well within design requirements down to a battery voltage of

Parts List

C1	33µF, 16V electrolytic
C2	470nF, ceramic
C3	1,000µF, 40V electrolytic with low E.S.R.
L1	100µH, 2.5A peak current inductor
R1	20.5kΩ, 1% surface mount
R2	2.0kΩ, 1% surface mount
R3	3.0kΩ, 5% surface mount or 1/8W
D1	1N5817 or equivalent Schottky Diode (1.0A, Vmax = 20V)
U1	LM2577T-ADJ National Semiconductor switching regulator

Optional, but recommended:

Heat sink for U1	23°C/W or better

Surfboard™ circuit board

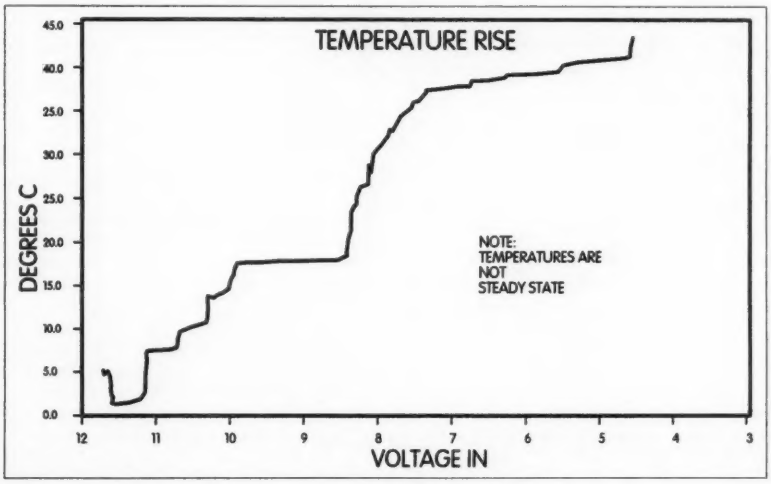

Fig. 4. Use a heat sink when you can, and don't burn your fingers.

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4.2V and then degraded "gracefully." An oscilloscope was placed on the output throughout the test and showed no peculiar changes or transients throughout the testing. There was, however, a high frequency switching spike on the output. Depending on your requirements, further filtering or shielding might be necessary.

Fig. 4 shows the regulator case temperature versus time. From this you can see that the power dissipation through the switcher is greatest toward the end of battery life when the boost requirement is the greatest. This may make a difference depending on your application.

Results

As you can see from the testing, all of the specifications were met successfully. The total final weight was 0.33 ounces (9.5 grams). The output voltage stayed at a stable 13.8V down to an input voltage of 4.3V (when given sufficient input current). The best result of all is that I not only have a useful power source for my MicroATV system, but I am no longer bothered by the thought of designing a switching power supply. Now if my brother could just give me another half-ounce or so of weight I could possibly squeeze in a video IDer, but that's another challenge... hmmm. 73

A Battery Tale

During the testing of the power supply, I was forced to learn (or is it relearn?) a few lessons about batteries. The first thing to remember in any boost-operating regulator is the old adage of "no free lunch." The power in must be greater than the power out. For example, that means that even if the regulator is nearly 100% efficient, the input current at 6 volts has to be greater than 1 amp to provide the rated output (13.8 volts @ 425mA).

The *Enercel® Battery Guidebook* is an excellent source of information on small batteries. This book showed the size "J" batteries to be rated at 0.55Ah (amp-hours). I knew that batteries are rated for a 10-hour discharge rate, but I expected their performance to be reasonably linear. The most common model for battery calculations is a pure voltage source in series with a resistor. That resistor is called the internal resistance of the battery. If a battery were perfectly linear, that resistance would be the same for any discharge rate. Using such a model implies that the "J" battery could put out about 1.1 amps for 30 minutes (1.1A x 0.5h = 0.55Ah). What I discovered was that for discharge rates less than the nominal 10 hours, the nonlinear behavior was severe. The life of the "J" batteries at those extreme loads was measured in seconds, not minutes! Based on this result, the battery size had to be increased to a 10Ah camcorder battery to test the supply at full load. This is too heavy for the rocket, so we are still searching for alternatives.

I think it would be an interesting project to run a series of discharge tests and calculate the change in internal resistance for various battery types. This would determine just how much we could push certain types of batteries. I suspect that similar characteristics will exist in each family type (nickel-cadmium, alkaline, lithium, etc.). If any of you have done tests like this, I would be interested in knowing the results. Better yet, find a student and help him/her make this into a science fair project—we would all benefit from that.

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Finding His Voice

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Jennifer Sanders
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In 1983, when my sister and I were young girls (I was around 13 and my sister Jacqueline was about eight), my father, Jack, began to teach the two of us Morse code. He had just earned his General class amateur radio license (KB6MLO) and he felt that it was never too early to start teaching his children. At the time, the two of us had no idea how important learning Morse code would prove to be later on in our lives.

We come from a family of hams. Both of my father's parents earned their amateur radio licenses in 1956 while living in the Panama Canal Zone. My dad's father, Bruce G. Sanders, Jr., started out with the callsign KZ5SS, and his mother Dorothy's call was KZ5SN. At the time, the KZ call was used only for Panama Canal Zone residents. After they retired and moved to Arkansas, their callsigns changed to WA5NUP and WA5NUQ.

My father did not earn his license until years later, around 1982. He started out with the call KB6MLO and quickly raced through to getting his Extra class license and a new call, WX6X. He became very involved in amateur radio and eventually became the president of his local amateur radio club in Santa Cruz, California, in 1988. He was very active and interested in getting the community, especially the younger generation, involved in amateur radio. He felt that amateur radio plays an important part in the community. He and my sister Jacqueline both operated the emergency ham radio frequency for Red Cross emergency communications during the days immediately following the Loma Prieta earthquake in the San Francisco Bay area in 1989.

During my father's most active amateur radio years I was a teenager, and though I learned the basics of the code, I never completed my training and did not earn a radio license. At that age I felt that there were other, more important, things to pursue, whereas my sister at age eight picked up the code and the theory quickly and began studying for her Technician license (this was before there was a "No-code" Technician).

Way back then, I felt, as many people do today, that Morse code was an archaic thing to be learning. I am a child of the computer age and learning something so primitive seemed ridiculous. What was I ever going to use Morse code for in an age where FAX machines and cellular telephones are so common? Luckily for my sister and me, our father did not think that the code was so outdated. He stressed that the code still had its place, and I learned the basic dits and dahs of the code alphabet. My sister became very proficient with Morse code, studied hard, and went on to earn her Advanced license at age 10 (KB6MTV) while my father earned his Extra.

Our father had moved to Florida to continue his education and was working on a Ph.D. in Computer Technology in Education. He still had been using ham radio, although much less frequently, and he still knew Morse code. In late 1996, he was to put his Morse code knowledge to good use.

On Sunday, December 15, 1996, Dad was riding his motorcycle home in Sarasota after completing his Sunday afternoon ride with a few of his friends,

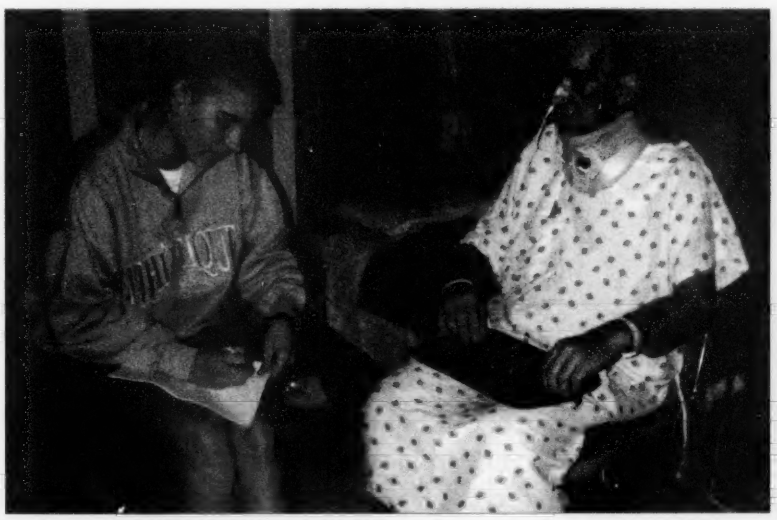

Photo A. *Jack Sanders WX6X using a practice key to send code to his daughter Jacqueline KB6MTV.*

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when a car pulled out of a driveway 25 feet in front of him. As always, my father was driving carefully and wearing the usual protective gear: a Bell approved helmet, leather jacket, and leather boots. He slammed on his brakes, but he did not have enough time to avoid the car. His head hit the bottom fender of the driver's side of the car as his motorcycle slid on its side.

He suffered massive fractures to his face, especially the right side, and broke three vertebrae in his neck. He was airlifted by helicopter from the accident scene to Bayfront Medical Center, about 40 miles away in St. Petersburg, where he was admitted in critical but stable condition, and was placed on a life supporting respirator.

He underwent a 10-hour brain and facial surgery on December 19, 1996. He had facial reconstructive surgery, his jaw was wired and he was given a tracheotomy. His right eye was so damaged from the impact of the accident that it could not be saved and unfortunately had to be removed. Thankfully he suffered only minor brain injury and came through the surgery well.

This began a nine-day stay in the intensive care unit while he recovered from his surgery. He appeared to be doing well, and the doctors told my sister and me that he was progressing normally. The problem was that although my father was coherent and conscious, he could not communicate because his jaw was wired shut, and the respirator that pumped air to his lungs through a hole in his throat made it impossible for his vocal cords to work. He could not see out of his left eye because his face had been so severely injured that the eye was still swollen and his vision was extremely blurry. The injury to his neck had made his upper body, especially his hands, incredibly weak; it was impossible for him to hold a pen or pencil.

My sister and I began to think about how we could communicate with our father. He was essentially in the dark and unable to communicate with us or his doctors and nurses. He could squeeze our hands to reply "yes" or "no" to any of our questions, but he was unable to tell us anything.

Then we remembered Morse code. My sister is not an active ham and had not used the code in quite a while. I had not used it in about 13 years, but we decided that if our father could send it to us, then we would force ourselves to remember.

We bought a practice key at a local amateur radio shop and brought it to the hospital. My sister put the key underneath my father's right hand, placing his index finger on the key pad and asked, "Dad, do you think that you can send us Morse code on this key?" He sent back ".. -.-. .- -.". Once I heard his "voice" through Morse code, I knew he was going to be okay.

Within a few days, my father was strong enough to send code steadily. It was an incredible relief for him to be able to communicate and it was wonderful to know what he was thinking. In no time he was sending pages and pages of code.

He was moved to a regular room for further recuperation. He still was using the key to communicate with us, but since none of the nurses or doctors could understand Morse code, my sister and I took turns staying with him around the clock to translate and assist him. He always had the Morse code key by his side, night and day. Hospital personnel would hear the noise from the key as they were walking down the hall and come into the room to find out what was going on. We received many enthusiastic comments on what a brilliant, helpful method of communication the code was. We were definitely the talk of the nursing staff.

My father was moved to Health South rehabilitation hospital in Sarasota FL on January 13, 1997, and is now able to speak again. Since that time he has often mentioned that Morse code really saved him. He says that before he was able to communicate he was frustrated, scared, and alone in the dark in his hospital bed. Whenever he mentions those times I think about how very scared I was until we tried using the code—and how much of a difference it made in all our lives. 73

Bicycles Across Switzerland

QRPing through beautiful Switzerland by bicycle is a blast!

Stephen Stuntz NØBF
P.O. Box 1462
Loveland CO 80539

I arrived in Zürich on August 30, 1996, with a home-brew 30-meter CW transceiver (designed by NN1G), a 2-meter Standard C108C handheld, and an HP-2001x palmtop computer (to send CW). Both radios, and the palmtop, were powered with AA batteries. The 30-meter dipole, made with thin wire and RG-174 coax, was stored on a cardboard toilet paper roll by tucking the coax inside and wrapping the wire outside. The Swiss PTT government agency had mailed the temporary license, HB9/NØBF, to Loveland 2 months earlier, thanks to the assistance of the ARRL.

We took a bus south to Einsiedeln, a picturesque winter vacation village with cobblestone streets leading through the town center to an old abbey. We spent the morning adjusting to the 8-hour jet lag: shopping, resting, and touring the 16th-century abbey, with its paintings, stained glass windows and a beautiful black stone Madonna. After a delightful lunch, several of our group headed to the hotel, overlooking the abbey, for a nap.

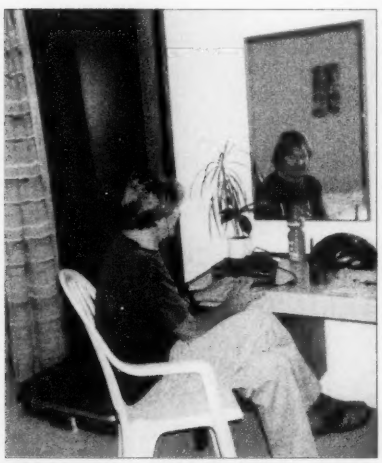

***Photo A.** Author operating at hotel in Boningen. (All photos courtesy of author.)*

In the afternoon I spent half an hour setting up a 30-meter antenna from my second-story balcony, by uncoiling each leg of the dipole off of the cardboard tube. The tube was taped to the balcony railing and each leg was attached to trees below, in an inverted vee configuration. Each leg was installed by tying one end of a length of fishing line to the antenna and the other end to a small lock. After tossing the lock off the balcony, I went outside, found the lock, pulled the dipole leg taut and tied the fishing line to a tree limb or fence post. The RG-174 coax was pulled out of the cardboard tube, uncoiled, and routed through the balcony door to the NN1G.

After connecting the headphones and the palmtop CW keyboard, I tuned around looking for some hams, but only heard one loud commercial RTTY signal on 10.110 MHz. Sending a CQ on the palmtop didn't result in a response, so I turned on the C108C and scanned 2 meters with no luck. Feeling disappointed, I headed downstairs to pick up my bike and prepare it for the next day's trip to Rapperswil.

The next morning Herman, our Dutch bicycle leader, yelled out "on your biiiiiikes!" as he hopped onto his bike from a running side leap, to lead our group over the breathtaking foothills to Zürichsee (*see* means lake in Switzerland). On descending hills overlooking Zürichsee, I pulled the C108C out of my pannier and scanned 2 meters. The

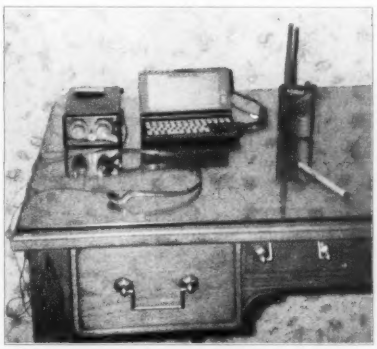

***Photo B.** Ham gear on Fribourg hotel desk.*

miniature handheld stopped scanning in a full quieting QSO spoken in German. Jim NØGTW, who had stopped to interpret, heard the two voices say "have a good day" before they signed off. We couldn't key the repeater, so we hopped back on our bikes, to catch the rest of our group, who had disappeared down the trail.

That afternoon, after we returned to Einsiedeln, I packed the 30-meter station into a backpack and headed up a steep grassy hill in back of the abbey. The trail meandered through pastures where sheep and cattle grazed, making beautiful music as the bells on their necks rang. After a steep ascent I stopped where the trail passed by a tall statue of a monk. The geometry was perfect—and irresistible. I strung together a sloper antenna by draping one leg from the arm of the statue and attaching the other leg to a picnic bench below. A group of singing nuns walked up, sat on the bench, and began a prayer meeting around the statue that I was using as an antenna support!

Embarrassed, I sheepishly repacked the antenna and headed up the trail for a second try, to another picnic area under a tree. The 30-meter band was in the same lousy condition as on the previous night except for a loud commercial RTTY station. It started to pour just as a faint CW signal from England appeared on 10.120 MHz, so I scurried back to the hotel.

"A group of singing nuns began a prayer meeting around my antenna-support statue!"

The next evening we arrived in Beckenried for a one-night stay. Still optimistic, I set up an inverted vee and scanned 30 meters. The band was alive with signals coming in from all over Europe, but I was unable to strike up a QSO. I also scanned 2 meters but didn't hear a soul.

We pedaled to Bönigen, nestled at the foot of the Eiger, Jungfrau and Monk mountains near Interlaken. On September 3, in this picturesque valley on the crystal-clear Brienzer See, where the elevation changes from under 1000 feet to over 13,000 feet in a few miles, I finally worked several stations.

Ras HB9ACV gave me a full quieting report from Burgundy, France, on 2 meters, from the shore of Brienzer See. Ras told me that he had moved from Switzerland to France 5 years ago but had not changed his callsign because of the retesting involved. The repeater that Ras and I used must have been placed high in the Alps to provide such excellent results with only 200 milliwatts! Later, I answered HB9O in Lucerne to ask about the location of the repeater and he asked, "*Sprechen sie Deutsch*?" I had to answer, "No!"

Back at the hotel I was feeling discouraged about my inability to communicate on 30 meters and didn't feel motivated to set up a neat antenna installed with fishing line away from the building. Instead I tossed the hot dipole leg out the second story, over a tree limb, and dangled the shielded leg out the window against the hotel to the ground. This configuration looked more like a tilted teepee rather than an inverted vee. At 9:30 PM, Ole OZ5DL, in Copenhagen answered a CQ keyed from the palmtop on 10.105 MHz, in spite of the unusual antenna configuration. He gave me a 569 signal report, said "73," and began chasing DX. Next I received a 549 report from Gunar YL2PG, of Riga, Latvia, on 10.110 MHz. Gunar was transmitting 100 watts into a dipole. I felt more confident after completing the QSOs because it seemed obvious that previous difficulty communicating on 30 meters was due to poor propagation and not operator error.

After leaving Bönigen, our group pedaled south to Bern, the capital of Switzerland. On the main street, between the river and the old city gate (built in 1200), stood Albert Einstein's house, where he lived and worked as a patent clerk, as he developed the Special Theory of Relativity. I paused there, feeling a sense of awe, thinking of how he had increased the understanding of physics, including radio waves used by ham operators all over the world.

From Bern we pedaled further south to Fribourg. On September 7, I put the C108C in the backpack and went shopping in the town square. At 5 PM, on top of a hill, I scanned 2 meters and found a repeater on 145.65/.05 MHz, busy with QSOs spoken in both French and German. Heinz HB9AGB, in Bern, responded to my call and explained that the repeater was located in the Alps North between Bern and Fribourg. He also explained that German is spoken by people living north of the repeater and French is spoken by the people living south.

At 8:10 PM, Jan SP2EXE, from Wejherowo, Poland, gave me a 569 signal report on 10.112 MHz, using the same teepee antenna configuration that

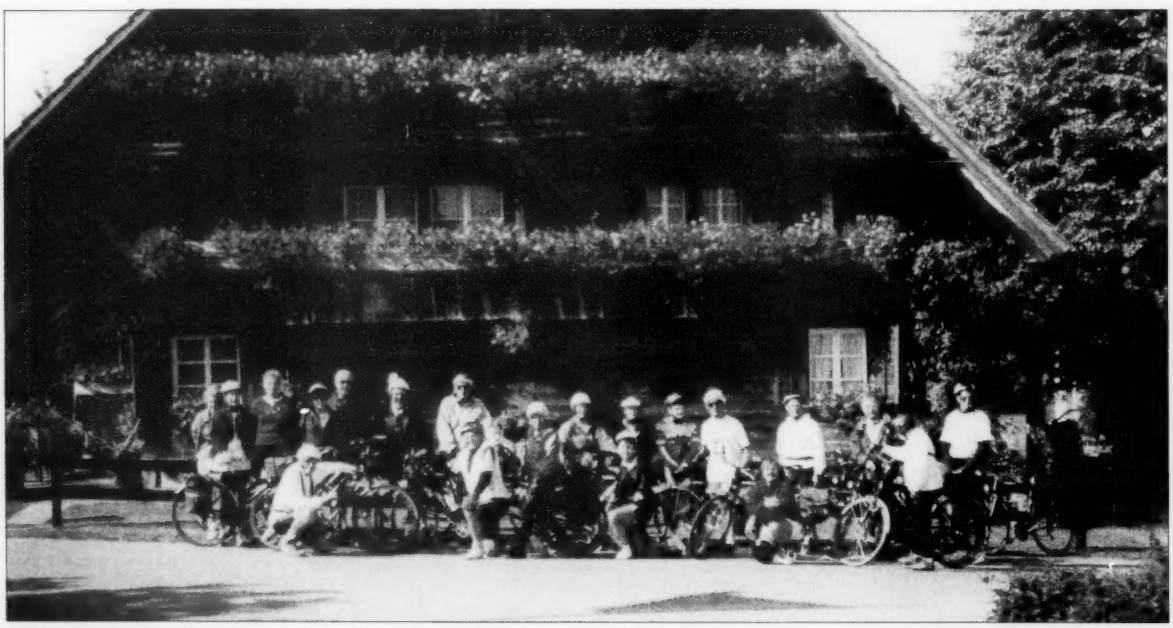

Photo C. *The bicycle tour group in front of a picturesque chalet.*

had worked in Bönigen. At 9:30 PM I answered Roy GW3SYL, in Bridgend, England, on 10.105 MHz, as he was signing off. He gave me a 579 report and stayed on the air for a few minutes because he wanted to hear about the QRP setup. I was surprised at the strength of my signal report because the NN1G power output was falling below half a watt due to low battery voltage. With no plan to recharge the batteries, I decided to pack the 30 meter rig away for the remainder of the trip.

On the final leg of the trip we pedaled through the Gruyère Valley to Montreux on the northern shore of Lake Geneva, the area known as the "Riviera" of Switzerland. I was not able to contact any hams in Montreux because the C108C receiver was overloaded due to cell phone transmitters.

On September 11 at 5:00 AM, our group boarded the bus to the Zürich airport, and by 7:00 PM we were back in Denver. As soon as I arrived home in Loveland I got on 2 meters and notified my friends in the Colorado QRP Club of the contacts I'd made in Switzerland. They reported that the HF conditions had been lousy and they were surprised that I had made any contacts at all. I shared my pleasure in communicating successfully with a simple antenna tossed out the window. They reminded me that the ability to communicate on HF is affected more by the condition of the ionosphere than it is by the quality of the antenna.

Next, I sent an E-mail message to Gunar, and 10 minutes later he responded from Latvia! He explained that he worked for the FCC-equivalent government agency in Latvia. A few days later I received a picture QSL postcard from Riga.

I am planning to bring ham radio along on the next Colorado Mountain Club bike trip to Italy. Some of the preparations include:

1. Applying for a reciprocal license. (Hopefully, ARRL/FCC will be successful in achieving reciprocal licensing, eliminating the need for a temporary license.)

2. Considering 40 or 80 meters until the solar cycle picks up.

3. Taking along a bicycle mobile whip antenna.

4. Learning to speak some Italian; getting on SSB instead of CW. 73

Photo D. Author's favorite bike trail, in the Alps looking toward the Gruyère Valley.

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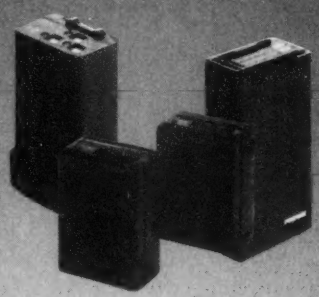

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CIRCLE 68 ON READER SERVICE CARD

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Madison AL 35738
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Last February 22nd, members of the HALO (High Altitude Lift Off) group gathered at the old airport in Huntsville, Alabama, to launch their latest balloon experiment. This was a test of the uplink and command module for a future rockoon (rocket launched from a balloon) flight.

The experiment

The payload, designed by Ed Myszka KE4ROC, consisted of a live color TV camera (from North Country Radio) that pointed down at the Earth below and also at a series of experiments that could be seen in the camera's field of view. Four experiments were visible; a red LED connected to one of the command channels, two rope cutter mechanisms and a small model rocket. The idea was to activate each of the experiments via a 2m touchtone uplink command and a custom touchtone controller board that Ed designed using a CM8880 DTMF decoder IC by California Microelectronics. The ATV transmitter was a PC Electronics KPA5-F and the antenna was an Olde Antenna Labs Mini-Wheel.

In addition to the ATV system, Ed included an APRS-formatted packet downlink on an Alinco DJ-180 tuned to 145.79MHz using a PacCOMM Pico-Packet Companion GPS board and a MIM packet module. The MIM board [available from Clement Engineering, (410) 268-6736] actually takes in the serial data from the GPS board and converts it directly to packet data.

Photo A. *Al Wright (left) and Tim Pickens of the HALO group prepare the ATV balloon payload for flight.*

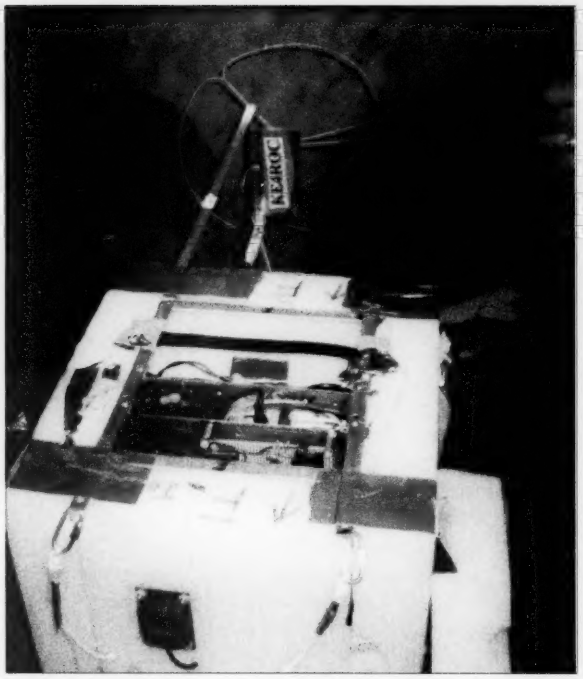

Photo B. *Close-up view of the balloon payload. Note the generous use of the scientist's secret weapon—duct tape.*

In a separate package, I made up a very small 10m CW beacon on 28.322MHz (20 milliwatts) that would transmit for at least two weeks.

Ups and downs

Gene Marcus W3PM and Ed KE4ROC set up their ground station on picnic tables underneath a shelter. Inflating the balloon was a bit tricky due to high winds, but we were finally able to string everything together and prepare for liftoff.

Even with the high winds, we had a picture-perfect liftoff as the balloon headed off to the stratosphere. Ed had a microphone on the side of the package hooked up to the ATV subcarrier and it was quite fun to hear our cheers of excitement downlinked from the balloon. It was neat to listen to the microphone audio. Cars and dirt bike noises could be heard by the balloon package from several thousands of feet of altitude. On one occasion we could hear a distant jet engine as well.

The jet stream was quite strong that day and the balloon quickly drifted toward the east and Chattanooga, Tennessee. At times the balloon was traveling over 150 mph.

At 80,000 feet, we decided to fire off the experiments. We could clearly see the red LED turn on and off when we hit the proper touchtone sequence. One of the rope cutters fired off as well. Unfortunately, the other cutter and the model rocket did not fire off.

The balloon popped at 90,000 feet over the eastern part of Chattanooga and parachuted down to land in a heavily forested wilderness area near Lake Ocoee, very near the site of the Olympic kayak races. The APRS GPS data worked well, but many participants had difficulties receiving the signals. It turned out that the radio had its 5kHz offset turned on, which made it difficult to receive. Nevertheless, we had good position data down to the last 7,000 feet. This helped to narrow down the search area to within a mile, but a mile in the wilderness is not quite the same thing as a mile in a cow pasture, let me tell you!

The search

Trying to play catch-up with a balloon traveling 150 miles per hour was a challenge, but the chase crew that left the launch site (Robby Sperr KF4LFQ, Patrick

Bramlett KE4QIC, Jared Cassidy KQ4VT and Chris Richardson N9QVI) closed in on the payload with help from Bill Nolle WA8INZ, who relayed coordinates to the team via HF and APRS. They were in a remote mountainous region and finally gave up the search after tromping through the woods for several hours in the dark. They were receiving weak signals from the payload, but could not pinpoint its location. Over the course of the next week, Rex Wagner, a relative of one of our team members, was able to see what he thought was an orange parachute dangling from a treetop on a ridge about two miles from the overlook where he was standing, but was unable to figure out just how to get to it.

With this information in hand, I headed out to the area the next weekend with Greg Allison, Chuck Grazioli, Ralph Fowler N4NEQ and Eddie Foust WD4JEM. Ralph and Eddie had an impressive array of DF equipment at their fingertips and spent the afternoon taking readings from many locations surrounding the payload.

At first I tried to find a road that would get us close to the payload, but when I saw the house at the end of the road—with trash scattered everywhere, pit bulls roaming free and the stuffed dummy (at least I hope it was a stuffed dummy) hanging from the tree limb—I decided that hiking in through the woods was a better choice!

We hiked in as far as we could while tracking the very weak (about 0.2 milliwatts) 2m harmonic from the 10m beacon. Greg hacked his way through the terrible web of brambles with a machete. It was incredibly slow going and we were all slashed up by the thorns at the end of the day. Just at sunset we finally got a very strong reading and realized that we were probably only a few hundred feet away. It was difficult to turn back at this point, but we didn't want to get stuck in the wilderness in the dark.

We met up with Ralph and Eddie and narrowed down our search area with their DF data. It appeared that we were only 400 feet away when we had to turn back. Ralph had an interesting encounter with one of the local store owners during their search. He had this tale to relate about their search:

Late in the afternoon, Eddie and Ralph piled out of Eddie's Trooper at a small grocery store and began using the hand-held VHF beam to take additional bearings on the package. This was to be our best bearing from the southeast side of the landing site. The lady working in the store wanted to know what we were up to...

"Looking for the Energizer® Bunny?"

"Yes, ma'am," Ralph replied. Then he told her what they were really doing.

She said (clueless as ever), "Well—I have lots of Energizers in here, but I think they're all turned off." Ralph and Eddie shook their heads and said the only thing they could in this situation:

"Well, ma'am, as long as he's out there, we'll be out here looking."

The recovery

As we headed back home that evening we talked to two of the local hams on the repeater, Joel Gamble KO4QC and John McClary KD4AFW. Even though John was 15 miles west of the landing site, he tuned in to the 10m frequency and had an S-9 signal from it! They were so excited about the prospect of finding a balloon package that Joel headed out with his friend Rusty Boling AE4BK over the next two days. As Rusty provided him with DF bearings, Joel finally found the package just a few hundred feet south of the point where we'd given up the search. It was 90 feet up in the tree and the model rocket was lying on the ground below it. Meanwhile, Tim Pickens and Gene Young K4ZQM, of our HALO group, had headed into the woods with a long pole and a three-wheeler motorbike. They encountered Joel and Rusty as they were on their way out. With their directions to the tree and by DFing the transmitter with an HT, Tim and Gene were finally able to reach the site and rescue the payload after it had been in the woods for nearly 10 days.

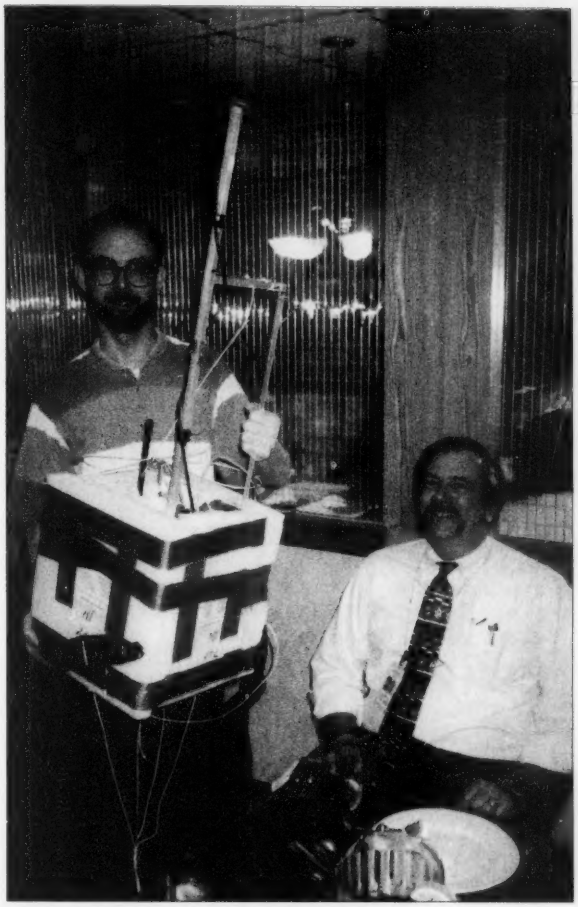

***Photo C.** Clay Sawyer (left) and Ed Myszka KE4ROC inspect the recovered payload.*

When Tim and Gene stopped back at the grocery store at the trailhead, the owner told them, "I didn't want to scare you fellers during your search in the woods, but look at some of the critters we hunt back there." What followed was page after page of photos showing 400-pound black bears and sharp-tusked wild boars. We decided it would not be a good idea to land in the wilderness anymore unless we could take Daniel Boone with us. 73

***Photo D.** Close-up view of the TV camera lens and plastic cover assembly.*

HOMING IN

Radio Direction Finding

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Web: [http://members.aol.com/homingin/]

Follow the fluxgate

"Has the bearing shifted?" I wonder how many hundreds of times I have asked that question of my navigator when I've been driving on a mobile hidden transmitter hunt (T-hunt). A sudden change of bearing means that you are getting close and it's time to pay more attention to cross streets and side roads. A few seconds of inattention at this point could result in passing by the target. On a first-finder-wins hunt, you will lose valuable minutes while trying to find a turnaround. On a hunt scored by odometer mileage, one slip could mean the difference between first place and a much poorer showing.

Along straight city boulevards, it's easy to detect a small shift in the bearing as you swing your two-meter yagi or quad. The usual pointer-and-compass-rose indicator on the mast bottom is all you need. But what about those meandering streets through new residential neighborhoods? In my area, they are seldom straight or aligned to the four major compass directions.

Worse yet are roads through canyons and over ridges. Even though it is necessary on a large percentage of hunts starting here in Fullerton, I used to dread going over the hills from Orange County to the San Gabriel Valley on Fullerton Road or Hacienda Road. The hidden T might be in the hills or over the top. It's hard to tell which when the signal suddenly gets strong, because of the many twists and turns of the road. There is no place to pull over on these two-lane highways and you are subject to horns and curses from drivers behind you if you slow down to less than the legal limit.

I longed for an indicator that would continuously show mast orientation with respect to true north, instead of just relative to the vehicle heading. With it, I could quickly detect bearings shifts no matter how much the road curves. Let's see, a shaft encoder could detect mast position, vehicle heading would come from a digital compass or GPS unit. Then I would have to put it all together with a dedicated computer and write a program to display it. Wait, there is a much easier way! Just put a remote compass sensor on the hand-rotated antenna mast! It directly senses beam heading with respect to north and displays it as the beam goes around.

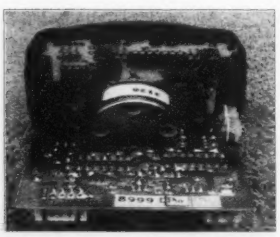

***Photo A**. The LiteOn DCS 800 automotive fluxgate compass can be used to display the position of your mobile beam antenna with respect to true north.*

An inexpensive solution

Several southern California T-hunters, myself included, have used Radio Shack™ automotive compasses as remote mast indicators for five years or so, in addition to the usual mast pointer. I have not written about it in this column because the model we use has long been discontinued by the Shack and was thought to be unavailable. With help from N4NEQ, KE6DKF and others on the Internet radio direction finding (RDF) mailing list, I recently found out that this device is still being manufactured by the company that designed it, LiteOn Automotive of Memphis TN.

The model DCS 800 automotive compass (**Photo A**) uses fluxgate technology to sense the Earth's magnetic field and display the sensor orientation on a rotating disc that you can mount in plain sight of all T-hunters in the vehicle. It is available for less than fifty dollars from J. C. Whitney™ Automotive Supply. You may also find it at your local recreational vehicle supply store.

The heart of this device is a small sensor cube, only 1 x 1 x 0.75 inches, weighing less than an ounce (**Photo B**). It consists of a toroidal (doughnut-shaped) core of high-nickel steel or ferrite material with three windings on it. The bottom (control) winding goes around and around through the hole of the doughnut and covers the entire surface of it. A 2kHz square wave is impressed on the control winding, causing the core material to go into and out of saturation at one magnetic polarity, then the opposite, and so forth.

Two orthogonal (oriented at 90 degrees from one another) sense coils are wound over the core and the control winding, not passing through the center hole. If there were no ambient magnetic fields, the alternating saturation flux lines within the core would always cancel and no current would flow in the sense coils. But Earth's magnetic lines of force are "pulled into" the high-permeability core each time it leaves the saturated state. This induces momentary current pulses from the two sense coils in proportion to the orientation of the Earth's field relative to each.

When suitably processed, amplitude and phase values of the sense coil signals are sufficient to determine the exact orientation of the horizontal component of the Earth's field—in other words, a compass reading. The two processed signals are called sine and cosine (sin/cos) outputs because they create sine waves 90 degrees out of phase from each other as the sensor is rotated in azimuth.

Note that the toroid core must remain oriented with its central axis exactly perpendicular to the Earth's surface in order to sense only the horizontal component of the Earth's field. The compass sensor rotates around this axis as bearings are taken. Any tilt of the axis from perpendicular causes pickup of vertical components of the field, resulting in bearing errors.

In the LiteOn compass, a special motor (resolver) turns to display the heading described by the sin/cos signals (**Photo C**). It has two orthogonal coils within, one for each signal, and a display shaft with a magnet on it. Even though it turns freely when power is off, response of this resolver in operation is somewhat "lumpy" or "sticky." That is, it does not react accurately to small (less than 20 degree) changes in direction and it has some backlash. Normal vibration of the vehicle helps overcome this characteristic.

Fluxgate compasses with precise digital readout and no backlash are available from Autohelm™ and KVH™, but they are considerably more expensive. Their automatic compensation features are not suitable for use on a rotating mast atop a moving vehicle. Besides, the analog mechanical disc of the LiteOn compass is far easier to read than a digital display when the sensor is attached to a manually turned RDF beam on a winding road.

Put it to work

The sensor and display are connected by a 10-inch five-wire cable. J. C. Whitney sells a 3-foot extension, but you can easily make your own from ordinary ribbon cable. Mine is six feet long.

There are three important factors to consider when you mount the fluxgate sensor on your RDF antenna. First, beware of the magnetic effects of your vehicle's body. At first, I was more concerned about the five-wire cable

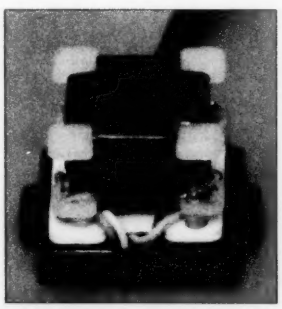

***Photo B**. The fluxgate sensor is smaller than a ping-pong ball. With the cover removed, you can see the sine and cosine windings crisscrossing the top and bottom, covered with tape.*

upsetting the operation of my RDF quad, so I mounted the sensor to a bracket on the side of the mast below the antenna, about nine inches above the roof. Accuracy and repeatability of the indications were poor. When I calibrated the sensor around the azimuth circle with the van heading east, the readout would be wrong when I was driving west. I moved the sensor to the top of the PVC mast, 28 inches above the vehicle roof. This solved the inaccuracy problem. The cable going down the mast through the quad has not affected the antenna's directional pattern.

Second, be sure that the bottom of the sensor remains level in operation. Mount it so that there is no tilt forward, backward or to the side at any setting of the mast. Any tilt will cause error due to pickup of vertical components of the Earth's field.

Third, remember that map plotting is far simpler with true bearings than with magnetic bearings. As you probably know, a magnetic compass does not seek out the geographical north pole. It is attracted to the magnetic north pole, which is near Hudson Bay in far northern Canada. To USA residents, this means that unless you live along a line from Indiana though South Carolina, you must correct your magnetic compass indications in order to have bearings relative to true north for plotting on standard maps.

Hams throughout Florida have only about two degrees magnetic declination, as this effect is called. If you are in northwestern Washington or northern Maine, the error is about 24 degrees—quite significant. You can find the magnetic declination where you live from a United States Geological Survey topographical map of the area.

Here in southern California, declination is about 14 degrees east, which means that 14 degrees must be added to magnetic compass readings to get headings relative to true north. If you live to the east of the zero-declination line, your declination is westerly and you must subtract the declination value from magnetic bearings to get true bearings. Fortunately, it's easy to mount the sensor so as to automatically compensate for the magnetic declination in your area. I did it by canting the sensor 14 degrees clockwise on the mast, as shown in **Photo D**.

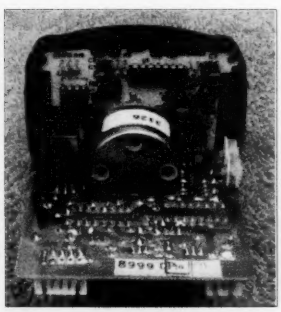

***Photo C**. Rear view of the DCS 800 display with the cover removed shows the two circuit boards. The round object in the center is the air-core resolver.*

A better display

"Stickiness" and backlash are artifacts of the resolver only. The sin/cos signals are delayed by integrator stages, but they follow directions quite accurately. You can readily extract these signals and connect them to a better indicating system of your own design.

Drive to the resolver comes from integrated circuit U2, an 8-pin DIP visible to the left of the resolver in **Photo C**. Pin 1 is the sine (east-west) signal and pin 7 is the cosine (north-south) signal. Maximum-to-minimum swing of each signal is about 4.8 volts.

U2 stages are voltage doublers as well as drivers. The output voltage range of U2 is too great for some applications, including the NorthScope to be described next month. More suitable tapoff points are at the outputs of U1, the stages that feed the 2x drivers. U1 is the 14-pin IC above and to the right of the resolver in **Photo C**. Pin 1 of U1 is the sine integrator output and pin 7 is the cosine integrator output. **Table 1** shows the approximate U1 output voltages for 16 compass headings. Note that the signals swing positive and negative with respect to a +4.2-volt analog reference level, which is one half of the +8.4-volt regulated supply line.

Photo E shows how I obtained the analog signals for my external display. U1 outputs are hidden under the resolver disc, so I tapped the sine output at the lower pad of R9 and the cosine output at the lower pad of R19. The analog reference voltage and circuit return are also required by the display; they may be tapped at the positive and negative terminals, respectively, of C13. This 100-microfarad electrolytic capacitor is next to U5 on the bottom of the horizontal circuit board, not visible in the photo.

A fluxgate sensor on your mobile beam's mast is an excellent aid to transmitter hunting on wandering roads. Next month's Homing In will have the details of an easy way to put the sin/cos outputs to work in a two-dimensional cathode-ray-tube (CRT) display

Continued

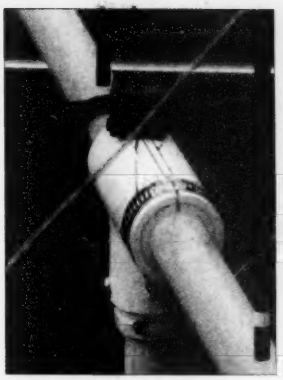

***Photo D**. I attached the sensor module to the top of the Cubex quad boom. Before mounting, I marked a line at exactly +15 degrees from the boom axis. I then aligned the sensor with the line to compensate for magnetic declination.*

Degrees	Direction	Sin Out	Cos Out
0	N	4.2	5.4
22.5	NNE	4.7	5.3
45	NE	5.0	5.0
67.5	ENE	5.3	4.7
90	E	5.4	4.2
112.5	ESE	5.3	3.7
135	SE	5.0	3.4
157.5	SSE	4.7	3.1
180	S	4.2	3.0
202.5	SSW	3.7	3.1
225	SW	3.4	3.4
247.5	WSW	3.1	3.7
270	W	3.0	4.2
292.5	WNW	3.1	4.7
315	NW	3.4	5.0
337.5	NNW	3.7	5.3

***Table 1**. Approximate voltages with respect to ground at the sine and cosine tapoffs from the DCS 800 before the 2x resolver driver stages.*

QRP

Low Power Operation

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Last month, we talked about rechargeable batteries. Lead-acid and NiCd are by far the most common types you'll encounter. However, in the next few years you'll be hearing more and more about the nickel metal hydride, or Ni-MH, and the lithium ion batteries. Let's take a look at them this month.

The Ni-MH battery

The nickel metal hydride battery is a close relative of the NiCd. It has a very similar discharge curve and has the same 1.2V per cell state of charge.

The Ni-MH battery has a specific energy that's about twice as good as a lead-acid battery. It also has a specific power density that's on par with the lead-acid battery. Ni-MH batteries also have great cold-weather performance, but they don't do as well as the lead-acid batteries at higher temperatures—so you could see lower than expected results from a Ni-MH battery if your Field Day occurs in a very hot location.

Also, don't be misled by some of the ads you see. Nickel metal hydride batteries *do* in fact suffer from the dreaded memory effect. However, it is not as pronounced as with the NiCd cell.

The Ni-MH battery has a lot going for it, and since no hazardous materials are used, it can be safely disposed of at the end of its life.

A point to mention before you drop a lot of money on new metal hydride batteries: Most of the old NiCd chargers won't like the new cells. If you change over to metal hydride, you'd better plan to spend money on a new charger, too.

You could easily home-brew one of these special chargers using the chip sets provided by Maxim™ as well as others. At one and two chips at a pop, they are a bit expensive—but a project like this would be a great one for a club.

Lithium ion batteries

You may have heard a lot about these guys. They are now popping up in laptop computers, at a premium price. Their energy density is much greater than the NiCd or the Ni-MH battery, and they have almost five times the energy density of a lead-acid battery. The lithium ion battery has a lot going for it, but there are a bundle of problems with these cells.

First, they're *expensive*. It's quite easy to get up to ten times the price of a battery pack if you choose lithium ion cells—and they're very picky about how they are recharged. You must use a special charger built *just* for these cells. Also, right now, they come in limited cell sizes. You won't find large-capacity cells on the market (that you can afford) just yet. As production increases, you'll see more sizes and lower prices.

Charging these special use batteries

While we can get by with a basic cheap-and-dirty charge scheme to fill up the lead-acid batteries, the Ni-MH and lithium ion require a bit more brains. Luckily for us, there are several companies that make special purpose ICs to do just that!

Primary cells

Although we've been talking about rechargeable cells, don't overlook the primary or one-time use cells. There's a lot of bang for the buck hiding inside an alkaline battery! Do you remember the old Icom™ IC-2AT handheld? For a few bucks, you could get the battery pack that would hold AA-sized alkaline batteries. You could talk and talk on the same set of batteries while the other guy went through three NiCd packs. Best of all, you could buzz into the local stop-'n'-rob on the way to the hamfest for a pack of batteries for under five bucks. Of course, once they were used up, you threw them out. And all those replacement batteries do add up, both on your budget and in the landfill.

RENEWAL® batteries

Thanks to Ray-O-Vac™ and their RENEWAL cells, you can get the power of the throwaway batteries with the ability to recharge them over and over. I've been using the RENEWAL cells in several sets of consumer equipment and have had very good results. Here are some hints you may want to try if you plan to use the RENEWAL batteries in your QRP equipment.

First, they really like to be recharged. Don't wait till they're dead before sending them to the recharger. Charge often and they'll last longer.

They appear to like loads that consume current. They love CD players and tape players. They don't care too much for low-current loads like radios (the old AM/FM types).

You must use the charger designed for the batteries. A NiCd charger will destroy the cells in a short time. See the March 1997 issue of *73* magazine for a build-it-yourself charger for these cells.

Next month, some antenna tuners and various antennas! 73

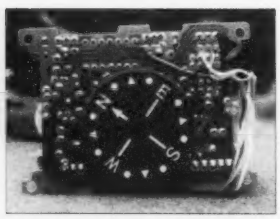

Photo E. *Front view of the vertical display board with the face plate removed. Wires have been added to pick up the sine and cosine signals, as well as the analog return and DC ground.*

HOMING IN *continued*

of bearings relative to true north. The NorthScope is all analog—no software or digital circuits are required. Meanwhile, keep the letters and E-mails coming with your RDF projects and news of T-hunting activities in your area. For more information on RDF equipment and links to T-hunters in your area, surf over to the Homing In Web site listed at the top of this article. Don't forget the forward slash at the end. 73

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How to Generate $1 Million In Extra Sales

In this video Wayne explains how almost any company can generate lots more sales using PR instead of advertising. Learn the secrets of how to write and get your PR releases published. Learn how to get product reviews which are pure gold for sales. Not one company in the ham industry is taking full advantage of the power of PR. This is something most ad agencies know little about. The video is a paltry $42.95ppd.

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Code Tapes

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73T13 **Back Breaker 13 wpm code tape** Code groups again at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. $7.00
73T20 **Courageous 20+ wpm coce tape** Go for the extra class license. $5.95
73T25 **Mind Boggler 25+ wpm code tape.** $7.00

available at hamfests for as little as $50, and they will do the job. A well-written DOS program will run perfectly on any Intel processor from an 8088 through today's fastest Pentiums—and in contrast, way too many Windows 95 programs run poorly on the single platform that supports them. DOS programs also tend to be very portable for the most part. A lot of my ham-related programs will run from a single disk. I also use the HP 200LX Palmtop for field ops and mobile packet with some very smartly designed DOS programs since their memory footprint is extremely low, using less than the 640k base, which is a standard part of any PC. Many of my all-time favorite programs are older shareware, freeware, and public domain DOS programs. They were designed by users for users and usually worked first time around. Features were added as necessary and the revision and upgrade numbers actually had meaning. The author actually conducted the debugging and beta testing, not the consumer out of his own pocket.

3. The Common User Interface is Microsoft's attempt to force us all to work the same way. It's great for the three "bread and butter" applications, namely word-processing, spreadsheets, and databases, but is irrelevant and a very uncomfortable fit for other kinds of software. Tell me, for example, how do the basic "File, Edit, View, and Insert" commands relate to a Morse training program or a rig interface program?

4. Windows 95 development is obviously not the bed of roses Mr. Carr claims. In almost every instance I can think of, the "new" Windows 95 versions of programs load and run substantially slower than their DOS antecedents. Maybe Visual Basic 5 does indeed approach the speed of Visual C, but that's just a way of saying how bad performance in Visual Basic has been since version 1.0. A Turbo C program on a 386 will beat the pants off either of them. How many of you remember the speed of Turbo Pascal on the 286 machines?

5. One of my biggest pet peeves is forced consumerism and the underlying implication that we are worthless as human beings unless we run right out and buy the "best, fastest, newest" products. Companies seem to be intent on rushing poorly designed and poorly tested products into the marketplace in a seemingly overzealous attempt to garner sales and grab the big bucks, not to mention the advertising push with a fair amount of trashing of other peoples' products. The poor consumer is forced to debug these products out of his or her own pocket, or have you noticed that Iomega charges nearly $15 for a tech support call and many others have instituted the pay-per-problem premise? Apparently, after surviving sufficient levels of frustration, complaints and jammed phone lines the consumer is made aware of a new soon-to-be-released version of the product; and, of course, the consumer is expected to pay for this version as well if he/she desires to have all his woes settled and have a program that actually works. More often than not, the new version costs more than the faulty one and basically all you are paying for is a patched version of the old program. So, where do we draw the line and stop buying into this marketing insanity? All in all, there are many "excuses" for offering MS-DOS software, and will be for several years. There are very many good and desirable DOS-based programs still on the market and still available through various BBS or Internet sites. One of the neatest things about DOS programs is that there are no GPF messages and the "you know you're gonna die" Close/Ignore buttons. Also, the memory reserves aren't occupied with all the graphic refresh rates! What is inexcusable is the way we have let Microsoft take control of the entire personal computing industry. And the way some of us appear to have swallowed Microsoft's propaganda.

As a known Mac user, both DOS and Windows are beneath my contempt. Hey, Carr, shame on you for getting us involved in a theological argument. Leave that mischief to me ... Wayne.

Continued on page 70

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HAMSATS

Amateur Radio Via Satellites

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Houston TX 77083

Satellites have been used for decades to send television signals across the continent and around the world. Today there are hundreds of channels of programming available from commercial geostationary-orbit satellites. With dishes as small as 18 inches, homes from urban to ultra-remote locations can have enormous viewing options; many amateur radio operators have often wondered why there are no hamsats for TV.

Full-motion, real-time, analog television is a very difficult mode. For terrestrial ATV (amateur television) enthusiasts, high power, big antennas, quality coaxial cable, low-noise preamps and wide bandwidth are required to work TV. ATV repeaters help dramatically, the same way FM voice repeaters allow fringe and low-power stations to communicate across large distances.

A repeater in orbit would be great, but there are a few problems. The bandwidth for earth-to-space or space-to-earth ATV is not available in the VHF and UHF regions; thus the lowest frequencies available for use would be the 1260–1270MHz satellite uplink band and the 2.4GHz satellite downlink range. Another problem is convincing the satellite builders that an OSCAT (Orbiting Satellite Carrying Amateur Television) would be a good idea. Most of the technical wizards who design and build the hamsats agree that full-motion TV is possible, but describe solutions that are digital in nature and require special modems and video compression methods. This would need special gear for the earthbound user, but would allow the "video" to be sent in a narrower bandwidth. Good quality analog FM ATV would require at least 10MHz, while digital compression modes could take less than 1MHz for similar results.

SSTV from orbit

Only 10 days after the launch of AMSAT-OSCAR-6 in October 1972, Don Miller W9NTP wrote a letter to the editor of the *AMSAT Newsletter* describing his efforts with WA9UHV to send SSTV (slow-scan television) images via the new satellite.

In his letter Don described systems that included equipment that might be found in a ham radio museum today, but 25 years ago represented state-of-the-art gear. HF transmitters with transverters and home-brew video samplers and modulators provided uplink signals while more home-brew equipment was used to view the black-and-white images sent through the Mode "A" (2m up and 10m down) transponder. These pioneering efforts have provided inspiration for today's video experiments and some exceptional possibilities for the future.

In his mid-seventies book, *OSCAR Amateur Radio Satellites*, Stratis Caramanolis recounted efforts by DL8AT and OE3KMA to send SSTV pictures via the Mode "B" (70cm up and 2m down) transponder on AMSAT-OSCAR-7. The year was 1976 and eight-second, black-and-white pictures were still the standard. These efforts led to additional image transfer techniques including facsimile (FAX) transmissions by DLØVB and others.

Digital pictures

During the 1980s, emphasis was placed on the purely digital modes like AX.25 packet. Today we have several digital-only satellites in orbit capable of providing worldwide store-and-forward services. Sending image files of all types via these electronic bulletin boards in the sky has become common. Moving pictures like .MOV, .AVI and animated .GIF files have also been uploaded to the 9600-baud digi-sats. SSTV real-time image exchange via satellite has declined, but thanks to advances in inexpensive digital interface techniques and individual efforts, SSTV operation gained some popularity while AMSAT-OSCAR-13 was in orbit. Dave WB6LLO hosted an SSTV net on the satellite on a regular basis.

With sufficient data transmission speed (requiring wider bandwidth), experiments with compressed and digitized video will be possible through Phase 3D.

SAREX, SSTV and ATV

Dr. Tony England WØORE took the Shuttle Amateur Radio Experiment (SAREX) equipment into orbit on the shuttle *Challenger* in August 1985. Part of the ham gear included a modified ROBOT 1200C scan converter for SSTV. The image-control software on the shuttle supplied automatic sequencing, providing two red-filtered frames (eight sec.), one green, one blue, a low-resolution color frame (12 sec.), and a high-resolution color image (36 sec.). Many stations monitored the signals using home-brew SSTV systems or new and expensive ROBOT equipment. Others simply recorded the warbling tones in hopes of someday decoding the cryptic sounds and viewing the pictures. Further experiments with SSTV from the shuttle continued on missions STS-37, STS-50 and STS-56.

In addition to sending pictures earthward, the shuttle apparatus can also receive and display images sent from earthbound hams. During Tony England's flight, a picture of the astronauts' wives was sent up to space and displayed on one of the monitors located in the aft crew station. The picture was stored and sent back to Earth a few minutes later. During STS-50, schools with suitable SSTV gear sent pictures of the students up to Dick Richards KB5SIW and the other ham crew members on board the *Columbia*.

There are advantages and disadvantages to shuttle-based SSTV operation. On the plus side, the signals are sent via two-meter FM transceivers. Signals are strong and color errors caused by frequency shift experienced using SSB is not a problem. The greatest disadvantage is the length of time available for picture exchange. Shuttle passes are usually very short, 10-15 minutes. The ROBOT equipment is capable of a 72-second mode, but images are usually sent in the 36-second mode to allow the exchange of as many pictures as possible. The ROBOT gear is also limited to those ROBOT modes hard-coded in the scan converter. More SSTV activity is expected for future SAREX flights.

Later FSTV (fast-scan TV) experiments to uplink standard 70cm ATV video to the Space Shuttle required FCC permission for participating stations to send 6MHz-wide signals to space. The 70cm satellite uplink band is normally only 3MHz wide. While the experiment worked for the few stations with high-gain antenna systems, high power and the FCC waiver, the activity will probably not be repeated. A move to higher frequencies and something better than the inside-the-window antenna will be needed to allow general ham involvement.

Mir and ATV

While the principal ham activities of the *Mir* crew are via FM voice or packet, there is also the SAFEX (Space AmateurFunk Experiment) repeater system. It was developed in Germany and then sent to the *Mir* space station. The primary unit is a 70cm in-band FM voice repeater, but the second radio unit (for later installation) includes a crossband linear transponder with a 1265MHz input and a 2410MHz output. While use of the 70cm voice system is geared more toward "normal" ham operation, the L/S-band (1.2GHz/2.4GHz) system is an experiment designed to test techniques that may become more prevalent on future manned missions. The microwave transponder is 10MHz wide using an IF (Intermediate Frequency) in the 70cm band. This bandwidth is capable of passing high-speed data or even television signals. The ATV group at the University of Bremen was tasked with the design and construction of many of the L/S-band components. The wide bandwidth of the transponder is sufficient to pass most AM or FM ham TV signals.

ABOVE & BEYOND

VHF and Above Operation

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San Diego CA 92119
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More on making silk-screened PC boards

I hope I gave you some insight last month on making PC boards such as the 3-band feed. Maybe this has whetted your appetite for more home PC board construction. This month, I want to give you more detail about the materials and methods used.

Alternatives

First, let's go over some alternatives to home PC board construction. Number one would be to go to a commercial board fabrication house. I have been told that charges for such a venture can go into the hundreds of dollars for the first run of a dozen PC boards or so. This is so that the production house can recover their initial setup costs. Board production runs after this initial setup can run in the under-$10-per-board cost range, depending on board complexity.

An alternative more in the amateur radio scheme of things, yet still using a commercial operation, is to use FAR Circuits. FAR specializes in amateur radio projects and has been providing PC boards for projects published in many amateur radio magazines. They also will do custom work at very reasonable prices. If you want to take this route and have artwork ready for board production, contact FAR for a quote. Their address is FAR Circuits, 18 N 640 Field Ct., Dundee IL 60118. Send an SASE or call (847) 836-9148 for voice mail or FAX communications.

If you are on E-mail, FAR Circuits can be contacted at [farcir@ais.net]. They also have a home page at [http://www.cl.ais.net/farcir/] for board listings and details. They are very reasonable and offer a quality product that you might want to take advantage of for amateur-only board production.

Make your own

What are the benefits of making your own PC boards? I started to make PCBs back in the late 1960s when I was quite involved in traffic handling using teletype machines (RTTY) for the Navy MARS (Military Affiliated Radio Service) program. In this effort, I was assisting in running a small parts bank distributing surplus component parts to Navy MARS members in the five western states as part of the 11th Naval District MARS program.

In this Navy MARS endeavor, I wanted to find an inexpensive method of producing PC boards to distribute for free with kits of component parts for AFSK (audio frequency shift keyers) and for RTTY converters. The push to RTTY operation meant a vast improvement in message handling when stations were teletype capable.

Getting started

Since the boards were provided for free and we did not have deep pockets, an economical method had to be found to produce them. This assumed that we had a negative of a board ready to start the silk-screen process. The negative was then transferred photographically to the screen material on the silk-screen frame.

There are several methods you can use to make a negative for silk-screen processes. The negative that is produced can be used not only for silk-screening, but also for many other methods as well.

The highest-quality result from a detail in copper on the PCB comes from the photoresist method. I had to pass over this method, though, as the setup cost was a little too high for the initial investment in material. When I looked at this method, the spray-on photosensitive resist and pre-sensitized PCB materials were too expensive or not of high enough quality for me to be interested in them.

Pre-sensitized PCB stock was a major cost, with boards priced at $10 for a small 4- x 6-inch one. Our efforts to hold down costs readily sold me on silk-screen printing.

Materials

Materials needed for silk-screen printing include:

- A few wooden frames to hold the screen mesh. I constructed frames 12 inches by 18 inches out of 2-inch-square frame stock (cut from 2x4s).
- Silk-screen mesh at $8.50 a yard.
- Nasdar™ Circuit Black #211 ink, $11.75 a quart.
- A quantity of paint thinner and lacquer thinner.
- Several rolls of paper towels (plain white).
- UV-light-sensitive contact silk-screen film, manufactured by Ulano Corp., 225 Butler St., Brooklyn NY 11217. My cost was about $50 for a roll of film 40 by 150 inches long, which should be a lifetime supply.
- Hydrogen peroxide, from any grocery or drugstore.
- Wooden work block (see below).
- Block Out™ water-soluble glue.

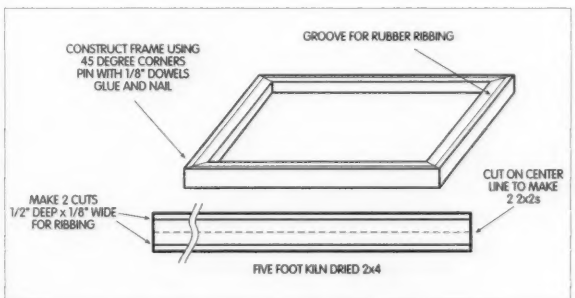

Fig. 1. The bottom of the silk-screen frame construction, showing the wooden frame groove and rubber ribbing that will hold the fine-mesh screen material in a firm, taut position. The cloth is stapled on the outer edge and then taped over to prevent fraying and loose threads dangling. Frame is constructed from kiln-dried 2x4 stock cut into 2x2 pieces.

HAMSATS *continued*

At 2410MHz, a signal can exhibit over 100kHz of apparent drift from AOS (Acquisition of Signal) to LOS (Loss of Signal) during an overhead pass. While SSB (Single SideBand) or CW (Continuous Wave) operation through the transponder will be a significant challenge, the wideband nature of TV will not. Automatic Frequency Control (AFC) circuits can deal with the tremendous frequency shift, allowing the receiver to lock in and hold the signal after initial tuning.

Why not OSCAT?

If the results of the *Mir* L/S-band transponder are promising, interest in producing a dedicated OSCAT may take hold. Most hams collect high-tech electronic devices, including camcorders, VCRs, and other video-related devices. An orbiting satellite capable of receiving and retransmitting ATV signals may be just the thing to spark the interest of many hams who have not even considered hamsat operation. It will certainly be a new challenge for dedicated satellite chasers. A microsat-type unit with receivers for command and 1.2GHz video input, coupled with a transmitter for 2.4GHz video downlink, can be the starting point for the program. AMSAT (The Radio Amateur Satellite Corporation) has already developed the spaceframe for this type of hamsat including batteries, solar panels, control systems and antenna placement. Single-channel FM satellites work—why not television? 73

• Rubber ribbing used for aluminum screen-door repair.

• Good-quality, heavy-duty, waterproof masking tape.

• Rubber squeegee.

The process

You start by contact-exposing the film to your negative in bright sunlight or high intensity UV light. I use bright sunlight of one-minute duration. The film can be handled in normal room light for several minutes with no ill effects.

Mix two parts water to each part hydrogen peroxide and develop the film for one to two minutes.

Now the critical step. Have a mildly aerated supply of lukewarm tap water running before removing the film from the developer. A small, scrap PCB can be used as a flat plate to put the film on under the running warm water.

Make sure that the film is always covered in water while you rinse it. After a short while, you will see contrast between the film removed and what remains on the vellum backing of the film, showing you the pattern to be transferred to the silk-screen frame mesh.

Prior to starting the film washing, you want to make sure you have a wooden work block of a size larger than the entire film being developed. After rinsing, the film is laid on top of this block. In the meantime, the screen is at the ready, its mesh being slightly moistened with warm tap water. Now the critical point: The film being rinsed is ready to attach to the frame when the pattern is clear enough where appropriate to pass ink through yet still the color of the original film (red) in protected areas.

At this time, remove the film quickly and place it face up on the wooden block. Place the silk-screen frame on top of the film and block. The frame's wooden edge dangles in midair around the block of wood, forcing contact of the screen mesh into the soft red transfer film and embedding the red film into the threads of the frame's screen mesh.

Assist the drying of the pattern by placing a paper towel on it and pressing gently to assist in embedding the film into the threads. A very easy touch is required here, as a hard one will distort the original pattern and cause it to mushroom out of shape. When the transfer film is dry, the Mylar™ backing is removed. It should come off easily. If there is any resistance to peeling this backing off, let the film dry for a another half hour or so.

When the backing is peeled off, a water-soluble glue called Block Out is placed on the screen frame on the outer edges of the transfer film. Be careful not to get any on the transfer film pattern. It goes on the edge of the film because this forms the final barrier to ink passing through other parts of the screen that are not protected by the transfer film. Only the parts to be printed on the copper PCB show through the screen without obstruction.

Frame construction

The cost for kiln-dried 2x4 wood to make wooden 2x2 frame members to hold the silk-screen (really nylon) material is quite low. The other related frame materials needed are the rubber screen-door repair ribbing used in aluminum screen-door replacement and a good-quality, heavy-duty masking tape. The cost of these items is minimal.

Have the 2x4 material precut into easy lengths to work with, say, five feet long. Cut a groove into the front face about half an inch from each edge. This groove is wide enough to be a tight fit for the rubber screen door ribbing when it is pushed into the groove. You don't want this to be very tight—just sufficient to hold the screen taut when stretched and held in place with the rubber ribbing.

The screen

The groove width is usually about 1/8-inch wide. See **Fig. 1** for the groove and the method of using the rubber ribbing to hold the nylon screen material to the wooden frame. The rubber ribbing is pushed down into the groove to tighten the screen material quite taut, but it's not so tight as to rip the nylon fine-mesh screen cloth.

When the material is tight, it will show signs of stretching when the middle is pushed with your finger. We just do *not* want to see any wrinkles in the material. When the screen is taut, staple along the outside edge of the cloth screen material to the outer wood strip on the wooden frame outer edge. Any excess cloth on the outside of the frame may be cut away. After excess cloth is removed, a paper tape or good-quality cloth waterproof tape can be used to hold the cloth edge to the wood frame end to prevent fraying and anything from catching the cloth on the surface of the frame. This surface is the bottom of the finished frame.

Turning the frame over, a similar smaller-width piece of tape is placed on the inside edge of the cloth mesh, with the outer edge on the inside of the box bottom. This tape will prevent the inks and solvents used in the silk-screen process from working their way under the tape and cloth at the edge of the inside of the frame. See **Fig. 2** for a look at the inside view of the frame. **Fig. 3** shows a side view depicting the hinge at the rear of the frame, which allows the frame to swing up for removal of the old blank or placement of a new one beneath the frame.

Ink time

Nasdar #211 Circuit Black ink is then placed in contact with the upper screen. It will not flow through the fine mesh unless the squeegee draws it and pushes it across the pattern. If you want, you can place a piece of paper on top of your circuit board prior to actually printing on copper. This makes a test print to see how well you can transfer (print) the inks onto the paper and what level of detail you have been able to retain.

Scrounging

Well, there's a preliminary run-through of the major steps of PC board silk-screening from an inexpensive point of view. Oh, yes: Where can you look for PC board material, particularly at low cost?

For amateur scroungers, the best way is to locate a PC board fabrication house somewhere in your area and try to purchase scrap pieces of copper board. They usually have large quantities of

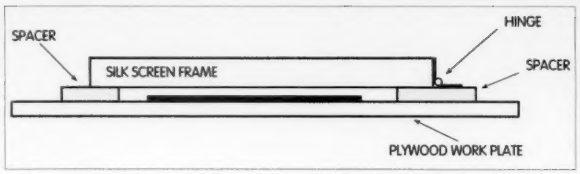

Fig. 3. Side view of silk-screen frame shows hinge to lift frame for board insertion and spacer to allow a small space between bottom of screen material and top of PC board. This ensures that contact with the PC board will be only at the edge of the squeegee as it is pulled along the length of the PC board pattern on the silk-screen frame.

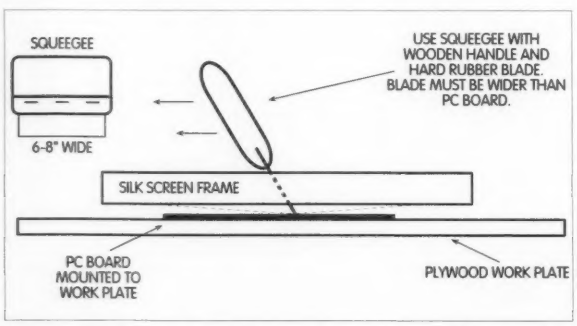
SQUEEGEE
USE SQUEEGEE WITH WOODEN HANDLE AND HARD RUBBER BLADE. BLADE MUST BE WIDER THAN PC BOARD.
6-8" WIDE
SILK SCREEN FRAME
PC BOARD MOUNTED TO WORK PLATE
PLYWOOD WORK PLATE

Fig. 2. Front view of silk-screen printing shows rubber squeegee pulled over the pattern on the screen material to draw ink along inner frame over the pattern for deposit onto the PC board.

HAM TO HAM

Your Input Welcome Here

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7462 Lawler Avenue
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Please keep your ideas, tips, suggestions and shortcuts coming my way, either by "actual mail" or cyber-mail. "Ham to Ham" is a reflection of your interests and input, and its content is only as good as the support that I receive from you, the reader. So send your tips to either of the addresses shown above and there's a very good chance that they'll appear in one of the future columns.

They're not just for PCs anymore!

With the current widespread use of multimedia PCs (personal computers), the availability of some pretty nice-sounding multimedia speaker/amplifier units also exists. These speaker/amplifier units are often available at hamfests, computerfests, or discount outlets at very attractive prices, and we hams might well consider their use in other areas of our hobby—they're not just for use as multimedia PC sound drivers anymore!

PC speaker/amps can, for instance, be used in a noisy mobile environment to augment the sometimes difficult-to-hear audio from an amateur-band hand-held portable transceiver or a portable scanner receiver. They can also be used within the home station to boost the audio from an amateur receiver, transceiver, DSP unit, or other audio source that might need just a bit of extra oomph.

Many of these PC speaker/amplifiers will operate quite satisfactorily from their own internal battery power, but if you'd like to supply longer-term DC power from the 12VDC cigar-lighter outlet in your car, or a small 120VAC-to-low-voltage-DC adapter in your home shack, then you may need to consider

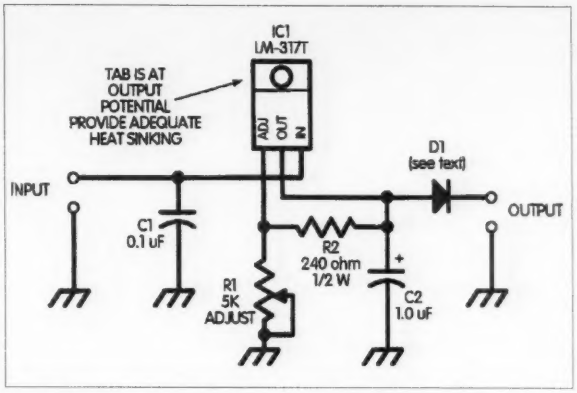

*Fig. 1. Basic variable regulator circuit using an LM-317T regulator IC. Adequate heat sinking must be provided for the LM-317T depending on the voltage and current to be handled by the device. Tab is at output potential. *D1 is needed only if there exists the possibility of back-feeding a voltage higher than the output voltage. There will be an additional 0.7V drop across diode D1.*

building a little circuit something like the one shown in **Fig. 1**.

The schematic diagram of **Fig. 1** shows an adjustable low voltage regulator that can be easily constructed on a small piece of perfboard, or even by directly wiring to the terminals of the regulator chip itself. It utilizes an easily obtained LM-317T regulator in a TO-220-style case (available from several of *73*'s advertisers), which will handle an amp and a half of output current (when properly heat-sinked), and up to 32VDC input voltage (the input must be DC, not AC). It then regulates that higher-voltage DC down to 3V, 6V, 9V, or 12V (or anything in between) for powering your PC speaker/amplifier.

Note (in **Fig. 1**) that you may elect to make the regulator circuit either variable (by the use of a 5k pot for R1) or fixed (by choosing a suitable fixed resistor for R1 from **Table 1**). If you don't intend to ever change the voltage, the fixed resistor option is the best choice because it will never change by itself (such as might happen were the pot to become "noisy"), and it's a bit less expensive to build it with a fixed resistor than it is with a variable potentiometer.

Whatever source of power you end up using, it should be reasonably well-filtered (so that audible hum isn't a problem), and it should, of course, be able to supply the current needed by the speaker/amp with some overhead margin for safety. It must also be of positive polarity. Other than those precautions, you should find the circuit pretty much universal in its application. You might also find that you can run

Fixed Resistor Values for R1

130Ω	2V output
310Ω	3V
490Ω	4V
660Ω	5V
840Ω	6V
1,020Ω	7V
1,200Ω	8V
1,370Ω	9V
1,550Ω	10V
1,730Ω	11V
1,900Ω	12V
2,070Ω	13V
2,250Ω	14V
2,430Ω	15V
2,600Ω	16V
3,000Ω	17V

***Table 1.** Approximate fixed resistor values for R1 in **Fig. 1** if the variable option is not needed.*

miscellaneous sizes or end cutoffs that are lying around, doing no one any good. Offer to pay double scrap value, and ask for a break because you are looking for PCB material just to make homemade boards for your amateur radio hobby.

Let the PC board house know this is not a commercial venture. And if you are allowed the courtesy of digging in their scrap bin, use leather gloves so you don't get cut, and leave the area cleaner than when you found it. This will give you the best shot at permission to scavenge again.

The small circuit board material that I usually find is in 12- by 12-inch pieces and smaller, usually with some small predrilled holes in a corner from an error in production. The scrap bin is usually filled with sizes suitable for amateur circuit boards—and then some. To locate these shops, look in the Yellow Pages™ under Printed Circuits, Silk-Screen Printing, or Wholesale Suppliers.

That's it for silk-screen methods for now. Next month, I want to get into a good shakedown test you should make before you use your portable microwave transceivers. What we will both go through is the pre-test in the shack prior to portable operation in August's ARRL 10GHz Contest. Hope to see you on 10GHz soon. Please note my new E-mail address at the top of the column, as I have shut down the AOL operation. 73, Chuck WB6IGP.

Editor's note: No mention of homemade PC boards would be complete without pointing out Kepro Circuit Systems, Inc., 630 Axminister Dr., Fenton MO 63026-2992; tel. (800) 325-3878 [in St. Louis, (314) 343-1630]; FAX (314) 343-0668. They offer a wide variety of products and kits, as well as a free catalog and free "how-to" booklet. Also, The Meadowlake Corp., P.O. Box 1555, Oneco FL 34264, offers a specialized iron-on film for PCB do-it-yourselfers. Write for further information. 73

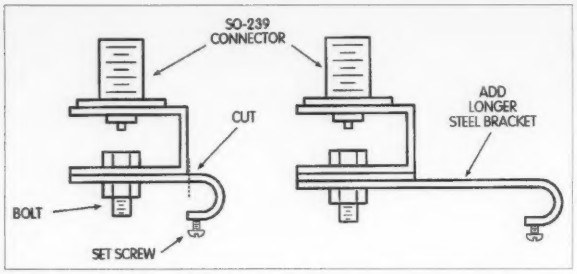

Fig. 2. *The original and modified trunklip mounts described in text by AD5X.*

two or more speaker/amps off one regulator module—again, depending upon how much current is drawn by each. Just be sure to stay safely under the 1.5A maximum limit of the LM-317T and ensure that the chip is provided with enough heat dissipation mass so that it won't go into thermal shutdown (a condition wherein the chip shuts itself off due to too much heat buildup internally). The heat sink mentioned can be a piece of scrap aluminum or one of the black-colored, finned heat sinks sold specifically to fit TO-220-style chips. Silicone grease should be used between the chip's tab and the heat sink mass for the best possible heat transfer characteristics (and to prevent "hot spots" on the chip's case).

With the LM-317T, just be careful not to allow the heat sink tab (or anything connected to it) to come into electrical contact with common ground. The tab on the LM-317T is at output potential electrically, so it must be isolated from the circuit common connection (negative DC lead).

The regulator chip has some built-in safety modes—protection against overheating (as mentioned) and short circuits (should the output circuit be accidentally shorted). One thing that these regulators won't tolerate is back-feeding a higher voltage into their output lead. This could happen if a battery pack of higher voltage is connected to the chip's output (without a blocking diode to prevent feeding the voltage back into the regulator) or if you accidentally connect the regulated bus across another higher voltage circuit bus. I've seen regulator chips literally explode with a bang (and in many flying pieces) under these conditions! Diode D1 on the schematic provides the necessary protection.

With proper use, however, it isn't difficult at all to incorporate an LM-317T into a universal regulator for powering almost any small accessory, including those bargain PC speaker/amps that often surface these days.—**de Dave NZ9E.**

Nearly FREE parts!

From George Primavera WA2RCB: "I recently encountered a failure of the external speaker jack on my Icom general coverage receiver. The jack was an 'Alps' (manufacturer's name) component, designed for mounting directly onto the PC board. The small cubical plastic shell which serves to hold the metal contacts of the jack assembly together had cracked across the top, rendering the little jack useless. Knowing that such a part was not the type normally available from convenience electronics outlets like Radio Shack™, I searched through the electronics mail-order catalogs. Unfortunately, the problem with mail-order parts, at times, is that if you don't have the exact part number and/or the technical specifications of the part you need, you might not get a suitable replacement. Then I happened to look at a couple of old VCRs that I had salvaged from a nearby TV/VCR repair shop.

"Most people now throw away their old VCRs rather than fix them, and I had a few of these 'throw-aways' on hand for their spare parts value. A TV/VCR repair shop in my town was more than happy to clear their shelves of a couple of these lifeless samples just for the taking. Guess what? The external audio jack attached to one of the scrap VCR boards was an exact replacement part for the one needed for my Icom! It was even made by the same manufacturer, Alps Electric Ltd.! Looking at the VCR board, it then became apparent that many of the same passive components (capacitors, resistors, jacks, push buttons, etc.) were identical to those used in my Icom. When you think about it, it makes sense; why use different production-line components for ham radio equipment and those that are used in Japanese consumer goods like VCRs, TVs, cellular telephones and the like? While there are certainly some components—namely higher-power RF parts—that won't show up in consumer electronics, many others do. Some just might be waiting for you to use, and for significantly less than the parts and labor costs you would have to pay if you didn't do the work yourself!

"One final example: My Yaesu FT-23R developed an intermittent PTT switch recently. I happily found an exact replacement for the Yaesu's switch behind the front panel of a scrapped Canon VCR I had picked up, free, at the local TV shop. The HT now works just fine, and the cost of replacement parts was about as reasonable as it gets! So next time you need a part, you might consider looking at scrapped consumer electronics items. Of course, it's always a good idea to pre-test the salvaged component before installing it in your ham equipment. Some of the newer VCRs also make use of many surface mount components, and these are a ready source for chip diodes, resistors and capacitors which are often needed for modifications to the newer, smaller ham gear. Look into these 'gold mines' and you might just save yourself a few hard-earned dollars (and not have to wait for the postman) the next time your ham rig develops a easily correctable fault."

Moderator's note: A man after my own heart! Thanks for the suggestion, George. You'll often find scrap VCRs, etc., at hamfests these days as well. They're usually just a couple of dollars, or even free, if you just stick around 'til closing time. Many vendors would prefer not to lug the "no sale" items back home again.

Slippery characters

From Richmond B. Shreve, Jr. W2EMU: "The shiny little plastic trackball pointing device used on many laptops can develop a tendency to slip due to dust, skin oils, or (often) from snacks we tend to keep close by while using our computers! I've found that adding some measure of texture to the surface of the trackball, however, can help to reduce this slippage problem quite a bit.

"Here's one procedure: First, round up a small (4" x 6") square of very fine sand paper. I used 220 grit, but a finer grit might be even better. Form the sandpaper into a tube slightly larger than the ball itself, with the gritty side on the inside. Remove the ball from the computer's trackball housing and place it inside the tube with your fingers over the ends. Now, shake... the tube, that is! As the ball travels back and forth inside the tube, all surfaces should become approximately uniformly roughened. It took about three minutes of shaking for a satisfactory result when I tried it.

"This procedure leaves the ball rough and gritty, but we're not done quite yet. To change this to a smooth but textured surface, place a small amount of toothpaste in the palm of your hand and 'massage' the trackball with it, taking care to rotate the ball so that all areas are equally burnished. Most toothpastes have a slightly abrasive component that helps to clean tooth surfaces. It will do the same for the plastic trackball.

"Now, after thoroughly rinsing and drying the ball, set it aside for a few minutes while you clean the socket. I found that regular drugstore eyeglass cleaner on a cotton handkerchief works well for this. Also, clean the little rubber wheels that the ball rides on in the trackball housing itself... the little wheels that generate the vertical and horizontal movement of the cursor. Blow away any residual lint from inside the housing and reinstall the ball and its retaining ring.

"The ball action may have a somewhat gritty feel now, but it will be far less easily affected by the oils and dirt that could have led to slippage in the future."

Oops!

From Bill Turner W7TI: "Oops, there goes a cup of coffee right across the front of your new

ham transceiver! It's a good thing that it wasn't turned on, though you still have the unpleasant job of cleaning it up—but what's the best method?

"Believe it or not, water (and a little mild detergent, if necessary) can often be the most effective method. Where I work, we wash PC boards each day, using a special detergent made for that purpose, as part of our routine cleaning procedures, and it works just fine. The key is to make sure that everything is thoroughly dried afterward, as quickly and safely as possible. We dry the washed boards in a 170°F oven for 30 to 45 minutes.

"Depending on where you live and the amount of minerals in your local water, you can probably get away with using ordinary tap water for the bulk of the cleaning, but always use distilled or deionized water for the final rinse. Distilled water is readily available in most supermarkets these days... Perrier™ water isn't necessary, HI!"

Moderator's note: Bill's methods can be the simplest and most effective way to handle this "sticky" problem! I've used similar procedures on really grimy items of electronic gear, but you have to be careful. Complete removal of easily damaged parts may be the safest approach. But if you decide not to remove them, keep all water away from transformers, relays, and delicate meter movements. I saw one of my power transformers go up in smoke, even after what I felt was a thorough drying, baking, and appropriate idle time. It was a high-voltage transformer for a monitor scope, and even the slightest dampness in the insulating layers of the transformer were enough to cause its demise. If you want to skip the oven-baking step, the drying process can be accelerated by using an ordinary hair dryer for a short period and/or a muffin fan left blowing on the chassis overnight. If you do use dry heat, watch for dark colored parts (black plastic panels for instance) becoming too hot, too quickly.

More backlip

From Phil Salas AD5X: this "happy mobiling" suggestion for hatchback owners: "So far, I've not been able to find anyone who makes a 'true' hatchback vehicle antenna mount. Though you can use something like the Comet RS-21 hatchback/trunklip mount on the side of the hatchback, you can't use it on the top lip of the hatchback door. The lip of the hatchback drops down below the vehicle's roof level, causing these types of mounts to hit the vehicle's roof before the hatchback door is fully open; at least this is the case with the Chevrolet Geo, the Toyota Tercel, and Ford Explorer hatchbacks that I've had experience with. To solve the problem, the vertical portion of the mount must be moved, at least 1-1/4 inches back from the hatchback lip.

"I've had success in modifying a Comet RS-9 trunklip mount (which sells for about $12) in this application, by simply making a new lip mounting bracket. I cut off the RS-9's original mounting lip, and bolted the 'modified' unit to a new custom-made extension bracket with a #8 screw. For this new lip-mount extension-bracket, I used a straight piece of steel from a standard 90° wood corner repair bracket (these corner brackets should be available at any well-stocked hardware store). I bent one end of the bracket into a 'U' shape, so that it would fit over the hatchback lip on my particular vehicle. Next, I drilled and tapped the steel bracket for #6 set screws. I've painted the whole bracket assembly black, and the final result looks pretty professional, if I do say so myself! You'll have to adapt this idea to your own hardware and vehicle clearances, but Fig. 2 should give you a rough idea of the approach that I used."

Good DXing

From Tom Hart AD1B: As the HF bands begin to make a comeback, here's a tip for ferreting out some of those often hard-to-find DX QSL addresses: "Most of us no doubt have had the thrill of receiving those rare DX QSL cards in our mailboxes, but locating the correct address for the DX station, or his or her QSL manager, can sometimes be problematical. There is a way, however, to ease the problem if you make enough DX contacts to warrant the outlay. The GOLIST, published by John Shelton WB4RRK (address: The Heritage Group, P.O. Box 3071, Paris TN 38242), compiles a monthly listing of DX stations and QSL routings for $3 per single issue, or $30 per year, for US mailing. They also have a computer disk version, a telephone BBS, and an Internet site for faster updates. They can be reached by phone at (901) 641-0109—tell them that you saw it in *73!*"

Murphy's Corollary: The ready availability of any electronic component will be inversely proportional to the absolute need for that particular part.

Many thanks to the contributors who make this column worthwhile each month—their input is directly proportional to the needs of all of us for interesting ideas. This month, they include:

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Be sure to check out the "Ham to Ham" column's home page on the World Wide Web at: [http://www.rrsta.com/hth]. You can also pick up at this site any back columns you may have missed or misplaced.

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HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

NASA helps teach science through the World Wide Web

Just as rapid changes in technology force us to make adaptations in our daily lives, so we adapt in our classrooms. The motivational techniques we use with our students must constantly be updated as the nature and backgrounds of the children we teach keep changing. Instead of being intimidated or overwhelmed by new technology, we must think of it as new and more stimulating ways of teaching about the world.

I recently read an informative article by Carol Galica in *Educational Horizons* which led me to some great discoveries on the computer. I suggest you pick any one of these sites to get started and see how your children react to it. Always remember that if you're creative and persistent you can enrich any lesson on space with a ham radio contact through the SAREX program. Call the educational department at the ARRL to get more details about SAREX. With the advent of Internet access in many schools around the country, NASA has been able to transfer educational data worldwide. The following sites contain the potential for great learning experiences:

• The NASA Lewis Research Center Learning Technologies K-12 homepage [http://www.lerc.nasa.gov/WWW/K-12] uses basic aeronautics principles to teach math and science. Educators will find published tutorials and lesson plans to assist them in making learning more fun for their students. Students can brush up on math skills as they take the 9th Grade Math Proficiency Test. Once students have completed the test, teachers can proceed with aeronautics activities that show various ways to demonstrate math and flight problems that correspond to aeronautics principles.

• (TIE) Telescopes in Education [http://encke.jpl.nasa.gov./TIE/TIE_index.html] gives students the control of a science-grade 24-inch reflecting telescope located at the Mount Wilson Observatory in California. The telescope is no longer being used by astronomers, so educators are being given the opportunity to reserve time on the telescope. Instruction is given to the telescope by the students via the computer. Images selected by the students are photographed and transmitted back to them over the Internet within minutes. Schools from all over the world have used the telescope. This site is certain to increase students' interest in and knowledge of astronomy, astrophysics, and mathematics.

• The NASA Shuttle Web [http://shuttle.nasa.gov] provides information on past, as well as future, flights. This site gets busy when there is a shuttle up because it provides live audio and video feedback, from launch to landing during the mission. The Shuttle Web has a section on sighting opportunities. Educators can find out when and where to look for the shuttle or the *Mir* Space Station in various cities.

• BAD Aircraft Design [http://fornax.arc.nasa.gov:9999/badweb/badweb.html] gives students an opportunity to design a subsonic airplane on line. The design has to be capable of providing nonstop service from San Francisco to New York. Students are allowed to change wing, fuselage, engine and stabilizer definition. Help is given on what each variable is and what it determines. The site immediately analyzes the decisions and outputs an image of the airplane, whether it would make the flight, its cost, and other information. This site is an excellent place for students to develop deductive reasoning skills.

• LIFTOFF to Space Education [http://liftoff.msfc.nasa.gov./kids/welcome.html] contains materials for a younger audience. NASA personnel volunteered their time to create materials using JAVA and FutureWave applications. Students can do interactive word-find puzzles, and an activity where they find out what their weight would be on another planet. There is also a quiz that prints out a certificate of completion when the student has finished it.

• NASA Quest [http://quest.arc.nasa.gov] provides students the unique opportunity to interact on-line with various NASA professionals and NASA projects. Currently being conducted are "Women of NASA" Web Chats in which individuals can communicate with female employees whose careers range from technical writer, to research psychologist, to astrophysicist. "Live from Mars" follows the progress of NASA's Mars Pathfinder and Mars Global Surveyor Missions. An archive of past projects is also kept at this site and includes the "On-line from Jupiter" and "Live from the Hubble Space Telescope" modules. All these projects are designed to motivate kids to pursue high-tech careers.

• The International Space Station homepage [http://issa-www.jsc.nasa.gov] starts off with a countdown to the launch of the first assembly mission for the space station. Technical information, as well as examples and explanations of what the space station will be used for, are posted here. At this site, students are able via E-mail to question scientists working on the space station. Since this is truly an international venture, students may find questions asked from all over the world.

• The Space Educator's Handbook [http://tommy.jsc.nasa.gov/~woodfill/SPACEED/SEHHTML/seh.html] contains the NASA *Spinoff '95* book. Spinoffs are products or procedures developed by NASA that are being used in industry or in the home. Some of the spinoffs described include a workout machine that is taken from one of the first training instruments used by the astronauts, golf aerodynamics used in golf balls, rescue equipment, the cordless phone, and the robot hand. Here students begin to see the process that products take from research to the neighborhood store. At this site, educators will also find space comics and a space calendar.

These are just a few of the NASA-created sites. NASA has sponsored many more educational sites. They are all geared toward making math and science education fun and informative. Some others you might want to try are:

- Exploring the Environment [http://www.cotf.edu/ETE]
- Volcano World [http://volcano.und.nodak.edu]
- Athena [http://athena.wednet.edu]

Bringing modern technology into the classroom via ham radio has always been one of our goals as educators. Now we have another powerful tool! 73

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Bytemark Corporation announces that its Amidon Technical Specification On-line Reference is ready for release to the amateur community. Based on the Amidon product reference book, this technical reference contains useful electrical and physical information on popular Amidon components and includes detailed technical data on every part in stock. Also included on-line is information on the use of these components and application of available formulas for optimal part selection.

New sections are being added regularly; there is no minimum for on-line orders. Also, CoreCalc!™ for Windows© toroid calculation software is available for download to registered owners of any powdered iron core from Amidon, with a rebate toward purchase of Amidon parts. Check it out at: [http://www.byte mark.com].

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Communications Simplified, Part 19

Multiplexing and digital data.

Peter A. Stark K2OAW
P.O. Box 209
Mt. Kisco NY 10549

So far, we have dealt with simple analog waveforms; now it is time to introduce multiplexing and data compression, and show how analog information can be sent through digital circuits.

Analog signals

Most things in nature tend to change more or less gradually. When you then convert these things into electrical signals, they too tend to change more or less gradually. That conversion is usually done with some sort of a transducer. In earlier chapters, we have already mentioned microphones and speakers as examples of transducers; though we didn't specifically say so, the video cameras and picture tubes of TV are also transducers—they also convert energy from one form to another.

But when we say "more or less gradually," we don't necessarily mean "slowly." Things in nature can change fast, too. What we mean is that they usually don't change *instantaneously*. Even a bullet, fast as it is, doesn't disappear from the gun and suddenly appear in the target. It may look that way to us because we're slow, but it doesn't take much to prove that the bullet moves through every bit of space between the gun and the target. It gradually moves from one place to another, passing through all the in-between places—even if that "gradual" motion happens pretty darn quick!

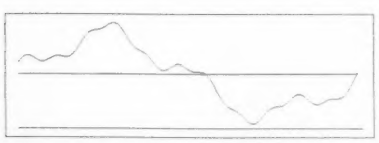

Fig. 1. A typical analog signal.

Fig. 1 shows what the output of a transducer might be when it converts some physical process into an electrical signal. This wave might represent the motion of a ship, or the motion of the diaphragm in a microphone, or the motion of a phonograph needle as it plays a record, or perhaps the light pattern of a TV picture. It is an analog signal, and it could be transmitted by any of the methods we have discussed so far—by wire or wireless, by carrying it as is or by modulating it on a carrier, etc.

There are times, though, when we don't want to transmit the signal as is; this could be for several reasons. One might be that we want to combine this signal with others so they can all be carried together through one wire (or one circuit); such combining is called multiplexing. Another reason might be that we want to reduce or avoid degradation due to noise or distortion; this is usually done by converting the analog signal to a digital one. Using multiplexing, and using digital circuits, are two totally different concepts, but they are often intermixed in some way and used together.

FDM: Frequency division multiplexing

Without calling it that, we have already discussed FDM in previous chapters. The whole idea of radio transmission—the idea of using carriers of different frequencies to carry different signals, all at the same time—is nothing but frequency division multiplexing. Each signal occupies a different range of frequencies; all of these signals are then mixed up and carried through the air to your antenna; the receiver then uses tuned filters to separate the signals and recover the one we want. Frequency division multiplexing merely takes a large range of frequencies, divides that range into smaller sections, assigns each signal that smaller range of frequencies, and then combines ("multiplexes") them together.

FDM can also be used through wires, of course. When Alexander Graham Bell invented the telephone, he was actually looking for methods to multiplex several telegraph connections onto one telegraph wire. His idea was to send the dots and dashes through the wire as musical tones of different frequencies, which could then be separated at the receiver with filters. It was not such a bad idea, but the state of electronics was simply not advanced enough at that time to get his system working. (Just as well—he invented the telephone instead!)

Eventually, the telephone company itself became a major user of frequency division multiplexing. It soon became obvious that it was uneconomical to devote a separate wire to carry each conversation, especially between cities. So they developed their "carrier" system, where each voice signal was modulated onto a different carrier; the carriers were then combined together onto one cable. Their first system used plain AM, and the carrier frequencies were multiples of 8kHz. For example, one voice signal

would be modulated onto an 8,000Hz carrier, whose sidebands would extend from just above 4kHz to just below 12kHz (since the audio went to just under 4kHz). The next voice signal, modulated onto a 16kHz carrier, would occupy the frequency range from about 12kHz to about 20kHz, and so on.

This telephone company FDM method has now been superseded with newer methods, but cable TV still uses FDM. TV signals, each occupying 6MHz of spectrum, are combined onto one coax cable and carried into your home. (This method too is about to be superseded with digital technology, though.)

WDM: Wavelength division multiplexing

Remember that frequency and wavelength are related by the equation

$$\text{wavelength} = \frac{\text{velocity}}{\text{frequency}}$$

Thus for every carrier's frequency there is a corresponding wavelength (assuming you know the velocity at which the signal travels in whatever medium you are considering). WDM or wavelength division multiplexing—that is, using a different wavelength for each signal—is therefore the same as frequency division multiplexing, where a different frequency is used for each signal.

In optical fibers, though, the color of the light is generally described in terms of its wavelength, not its frequency. So using different colors for different signals—that is, sending several different light beams through a fiber at the same time—is referred to by the name WDM rather than FDM. (Using the term "color" is a bit misleading, since "color" implies something that the eye can see, whereas most practical fiber-optic communications systems use invisible infrared light.)

WDM is an extremely useful technique with fiber optics, because it greatly increases the amount of information that can be sent through a single fiber. The bandwidth over a single light beam is primarily limited by the dispersion in the fiber; using two or more different color light beams allows use of the full bandwidth for each different beam. As of 1996, for example, several systems have been demonstrated that use 50 or so light beams, each carrying 20 billion bits per second, to carry a total of 1 trillion (10^{12}) bits per second of data through one fiber.

Sampling

Aside from FDM and WDM, most other multiplexing methods involve some sort of sampling. Sampling involves providing small portions of a wave, called samples, with enough detail to allow the receiver to fill in the missing parts.

For instance, consider the sentence "H_w a_e y_u?" Even though there are some missing letters, with a bit of time you can probably figure out that the sentence should read "How are you?" This is an example of sampling.

Fig. 2 shows how sampling might be used in communications. The top trace shows the same waveform we saw earlier in **Fig. 1**. The center trace shows how we have removed most of the wave, and retained just small samples, taken at some periodic interval (which we will discuss shortly).

In an electric circuit, however, it isn't possible to send these samples with nothing between them—something has to connect them together, even if that "something" is zero volts. The result might be the bottom trace in **Fig. 2**, which shows that each sample becomes a pulse, separated by a zero-volt signal between them.

Let's return to our example of "H_w a_e y_u?" We need to do two things to make sure you can correctly decode this sentence: (1) make sure that the samples come often enough that the missing parts between them are small and can be reliably filled in, and also (2) make sure that the samples themselves are correct. For instance, "H__ __e _o_?" does not contain enough samples, because it might be misunderstood to mean "His fee too?" Likewise, "H_s a_e y_u?" has a mistake and would also cause an error.

In terms of electrical sampling, these two requirements mean that samples must be taken often enough, and accurately enough, so that we can later fill in the missing pieces without introducing any new errors. Let's now look at these timing and accuracy requirements in more detail.

Sampling rate

The rate at which samples are taken is called the sampling rate. So how often should they be taken?

The answer comes from the Nyquist Sampling Theorem: In order for the samples to adequately represent the analog waveform, the sampling rate must be at least twice the highest frequency contained in the signal. (The fine print says that the sampling rate must be ever so slightly more than twice as high.) Looking at it from the other direction, the highest frequency component present in the analog signal being sampled must have a frequency less than half of the sampling rate.

There's still another way to look at this: Consider the fastest possible cycle in the analog waveform; if you have slightly more than two samples of that cycle, you can reconstruct the entire cycle from the samples.

A CD, or compact disc, makes a good example. The audio signal on a CD has a frequency range from 20 to 20,000Hz. Since the highest frequency is 20,000Hz, any sampling rate above 40,000 times per second—twice the highest audio frequency—will provide enough information to allow the CD player to completely reconstruct the audio signal from the samples. (Compact disks sample 44,100 times per second to provide a slight safety factor.)

To understand the Nyquist Sampling Theorem, note that its purpose is to make sure that the original waveform can be reconstructed from the samples. So let's see what is involved in reconstructing a wave from samples by looking at a "connect the dots" puzzle like the simple one in **Fig. 3**, which shows five numbered dots to be connected. Most people given this puzzle would use straight lines to connect the dots, as in the top trace. But when you think about it, there are zillions of different ways to

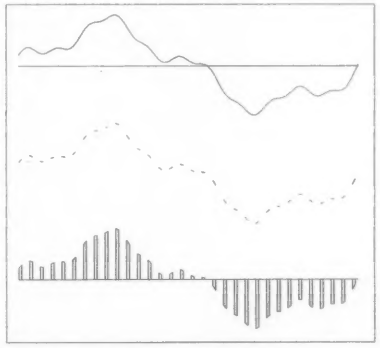

Fig. 2. Sampling an analog waveform.

connect two adjacent dots—you can use straight lines, curves, zig-zags, curlicues, or anything else that strikes your fancy. In other words, if the dots represent samples of a wave, there isn't necessarily just one unique wave that can be reconstructed from these samples.

But suppose we lay down two simple rules:

1. No sharp corners are allowed. This automatically rules out using straight lines to connect dots, because this would always leave a corner where two such lines meet at a dot (unless three dots are lined up in a line, which is unlikely to happen very often).

So this rule means that adjacent dots can only be connected with curves. But it also puts a constraint on the curves. When two curves meet at a dot, no sharp corner is allowed between them, either—they must blend smoothly into each other without making a corner. This still leaves a lot of possible curves that would fit, so we make one more rule:

2. No sharp bends. Any curve connecting two dots must be the "least curvy" curve that fits rule 1. In other words, only the smoothest curves are allowed, curves which bend as little as possible. Any bends in a curve must have the largest possible radius.

With these two rules in effect, we suddenly discover that there is only one possible way to connect all the dots, similar to the bottom trace in **Fig. 3**. This unique connection is the analog signal that would be reconstructed from the samples.

How do we enforce these two rules? We note that waves that contain a lot of tight curves or even corners contain very high frequency components (think of the square wave, which has right-angle corners and harmonics that extend way up to infinity). The Nyquist theorem, by saying that the highest frequency in the analog signal

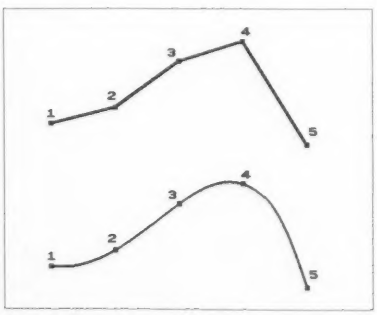

Fig. 3. Connecting five dots.

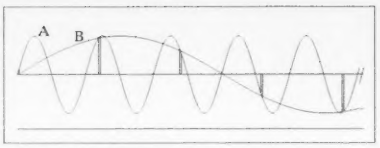

Fig. 4. Aliasing error.

must be less than half of the sampling rate, puts a limit on high frequencies.

In a very concise way, the Nyquist theorem essentially says this:

An analog signal that has sharp bends also has high frequency components. This means that the sampling rate must be very fast—twice as fast as the highest frequency component in the wave. When you sample this fast, then the samples are so close together that the portion of the waveform that connects any two adjacent dots (samples) is so small that it doesn't have a chance to do much bending.

If the sampling rate is not fast enough, then reconstructing the original wave from the samples will lead to a type of error called aliasing. **Fig. 4** shows an example: Curve A is the original wave being sampled, but the samples are not taken fast enough (i.e., there aren't more than two samples in each cycle of the waveform). Curve B shows that there is another wave that also fits the same samples, and fits them *better* because it has more gentle curves and bends. Thus the reconstructed wave would be B instead of A, and this would lead to very serious errors.

Well-designed sampling systems thus always contain anti-aliasing filters, which are supposed to remove any analog signal whose frequency is more than half of the sampling frequency.

But filters are never perfect. In a CD recorder, for example, a filter which would remove everything above 20,000Hz would also remove some of the signal below 20,000Hz, thereby reducing the frequency response of the CD. This explains why CDs are recorded with a sampling frequency of 44,100Hz, instead of just 40,000Hz. This gives an extra margin of safety, allowing the anti-aliasing filters to remove almost all signals above 44,100/2, or 22,050Hz, yet retain almost all of the desired audio signals below 20,000Hz.

Sampling accuracy

In addition to sampling an analog signal often enough, we must also sample it accurately. The required accuracy depends on two factors—how well we need to reproduce the original analog signal, and how we intend to send the value of those samples to their destination.

Let's use the compact disc as an example. CD specifications often list the signal-to-noise ratio as about 96dB. This means that any noise, such as what might be introduced by slight errors in reconstructing the signal from the samples, should be 96dB weaker than the loudest music to be recorded. (Signal-to-noise measurements always use the loudest music so as to give the best numbers.)

Remembering the formula for calculating dB from a voltage ratio, we note that

$$20 \log \frac{\text{signal}}{\text{noise}} = 96$$

Solving this for the numerical ratio, we get about 63,100. Hence, if the music is to be 96dB louder than the noise, then it must have about 63,100 times as much voltage. We will see shortly that the actual ratio used is 65,536, giving an actual signal-to-noise ratio of about 96.3dB. In other words, any errors introduced by the sampling must be smaller than about 1/65536 of the maximum voltage. This implies that any voltage measurements in sampling the music must be accurate to at least one part out of 65,536 or so.

This short calculation tells us how accurately we must perform the sampling of the original analog waveform to achieve a certain signal-to-noise ratio. But we must also consider how we are going to send these samples to their destination. There are basically two approaches to do that. In the analog approach, we send the values as analog quantities. For example, we might use a voltage or frequency to represent the value of each sample. In the digital methods, we convert the value of each sample into a number, and send those. This gives us a number of different methods.

TDM: Time division multiplexing

Just as FDM takes a range of frequencies and cuts it into smaller slices, so Time Division Multiplexing or TDM takes time and cuts it into smaller slices, one for each signal to be carried.

The bottom trace in **Fig. 2** actually shows one such signal, as sampled and converted into pulses. These pulses are

narrow enough that pulses representing another signal could be squeezed into the empty space between them; in this way, a number of different signals could be carried together along the same path.

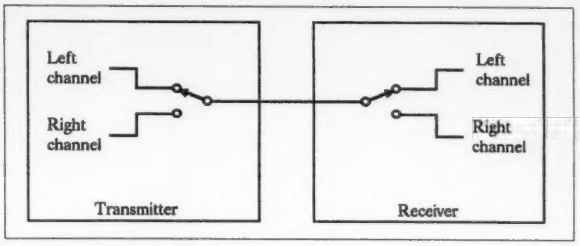

Fig. 5. FM stereo viewed as TDM.

Previously, we discussed FM stereo. We mentioned that the L-R, or the left-minus-right difference signal, was modulated as a DSB signal onto a 38kHz subcarrier, and that matrixing was used in the stereo receiver to combine it with the L+R signal to produce separate left and right channels. But then, in just one sentence, we casually added that this was the old-fashioned analog approach, since modern equipment used a different way of accomplishing the same result. Because most books and articles describe stereo FM the older, analog way, many people don't understand the newer technology.

The truth of the matter is that modern FM stereo equipment uses time division multiplexing! **Fig. 5** shows a simplified diagram of how it works. The switch on the left, inside the transmitter, is the multiplexer. It samples the two channels at a sampling rate of 38kHz (which is more than twice FM radio's highest audio frequency of 15kHz) by continuously flipping up and down. At the same time, another switch in the receiver (the demultiplexer) also flips up and down at the same 38kHz rate. The two switches are synchronized so that both are up or both are down at the same time; this makes sure that the left and right channel signals are properly steered to the correct output. The receiver then uses the samples to reconstruct the original waveform for each channel.

The actual circuitry doesn't use switches, of course; since they would not be fast enough. Transistor switching circuits are used instead; they are synchronized by the 19kHz pilot tone.

It is not easy to show mathematically that this TDM circuit gives the same results as the DSB approach, so **Fig. 6** shows the waveforms, developed by computer simulation.

The two waveforms assume that the left and right channel both contain a 1,000Hz sine wave, but that these two channels are out of phase. The sum, L+R, is therefore zero, while the difference, L-R, is a pure 1,000Hz signal. The top waveform in **Fig. 6** shows the resulting DSB signal. Since there is no sum signal, we have only a 38kHz DSB signal consisting of two sidebands, one at 37kHz and the other at 39kHz. When these two are mixed, we get the top waveform.

The bottom waveform, on the other hand, shows TDM, switching back and forth between the two out-of-phase 1,000Hz signals in the left and right channels. You can see that the bottom wave is very similar to the top; it just has some sharp corners, which could easily be smoothed out with a low-pass filter.

Aside from the fact that it is cute to compare DSB with TDM, there is another point worth noting here—the fact that TDM requires a substantial bandwidth. Even aside from the sharp corners (which add harmonics, just as squaring up a sine wave into a square wave adds harmonics), TDM introduces sidebands around the sampling frequency. In the case of FM stereo, for instance, sampling between the left and right channels (each of which has a frequency response up to 15kHz) at a 38kHz rate gives us the same signals as we discussed previously (May 1997): the L+R signal up to 15kHz, and a L-R DSB signal extending +/-15kHz from 38kHz, i.e., from 23kHz up to 53kHz.

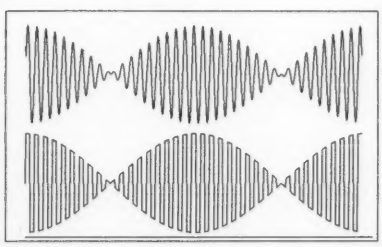

Fig. 6. Comparison of TDM and DSB modulation.

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Vintage Review: Yaesu FT-727R Dual-Bander

Save money on an all-purpose HT.

Photo B. View of front controls, Yaesu FT-727R.

Harry M. Johnson NV7K/6
1615 Wood Street
Eureka CA 95501-4672

Many new amateurs are coming into the hobby today via the no-code technician license, and most begin their "careers" on 2m and/or 70cm FM. They don't have the capability that young hams had in the past to pick up and modify surplus gear or home-brew a first rig. Most buy one of the many hand-held transceivers on the market and use it in its intended way as well as for a base station and a mobile radio. Even though these rigs are relatively inexpensive considering the value of today's dollar, they still are somewhat pricey if you are a young person or someone who is also trying to feed a couple of hungry children.

One way to obtain an inexpensive rig is to buy a good used one. Besides the need to know about the working condition of the radio, you should try to learn whether or not this model has the "bells and whistles" that you are looking for. A daunting task indeed, since so many models of hand-held FM transceivers have been produced in the past ten years.

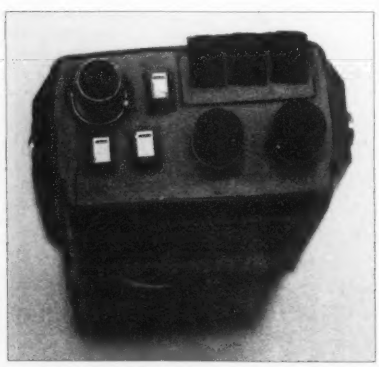

Photo A. Top deck controls, Yaesu FT-727R.

The Yaesu FT-727R was one of the first of the dual-band amateur HTs. It can transmit and receive on the amateur 2m and 70cm FM bands. In 1987, when this radio came on the market, extended receive capability was not an available option. The frequency coverage on two meters is 144.000-147.999MHz; on 70cm, it covers 440.000-449.999MHz. The power output is 5W at full power on both bands and 1/2W on low. It is much larger than contemporary dual-banders, but still a very usable size at 200mm high x 71mm wide x 38mm deep with attached standard equipment battery, the 12.5V, 500mA FNB-4A. Its weight is 616 grams.

Physical layout

The controls and connection points on the top deck (**Photo A**) are: BNC connector for the antenna, VOX switch toggles that function on and off, mini phone jack for Yaesu's CAT (computer-aided tuning) function, mini and micro-mini phone jacks for the earphone and external mike connections respectively, high-low transmit power switch, lamp switch (illuminates LCD display) and squelch and on-off volume rotary pots.

On the left side of the rig near the top is a bulge that houses the push-to-talk switches. In this case there are two distinct switches, one above the other, and either can be used. In the European model the top switch was the tone burst switch necessary to access European repeaters. The battery lock button is also found on the left side. On the right side opposite the push-to-talk switch is the function switch. The push-to-talk and function switches are covered with a rubber membrane which effectively keeps out moisture and dust.

The front panel (**Photo B**) has two LEDs at the upper left. One is green while the squelch is broken and red while the PTT switch is depressed. The other comes on when the battery voltage gets below 7.0. A very ample speaker and a mike are housed behind a grill. The LCD display is below the grill, and a 20-button keypad below that. On the rear at the bottom of the belt clip and under a rubber cover is the VOX sensitivity switch.

The LCD display tells you just about everything you would ever want to know, including battery voltage. All data entry is done via the keypad. The D key puts you in the dial mode and allows frequency entry. Another key toggles between the VHF and UHF bands. Ten memories are available between the two bands as well as a call memory for each. The keypad sequence for memory entry is: D, key in the frequency, M and then the memory number. Pressing MR puts you in the memory recall mode and then the memory number key gets your desired pre-entered frequency. The memory will hold the repeater split (+, -,

or simplex) as well as tone encoding and decoding information (more on tones later). Each key has its primary use marked on it and its secondary use just above. By holding the function switch and then pressing a key, its secondary function is called into play. The 16 DTMF tones are produced by the leftmost 16 keys. A, B, C, and D tones are not marked on the keys but are generated by the keys in the fourth column from the left as you go down.

The two rightmost keys on the top row are down and up keys, respectively. They will step the frequency up and down from the beginning setting, or when in the scan mode will scan the memories up or down. To initiate scanning, either the up or the down key must be depressed for one second and then released. To stop scanning, press the PTT switch momentarily.

There is a double horizontal arrow key to reverse the transmit and receive frequencies so you can "listen on the input." The "*" key will bring up the call frequency on either band. The "#" key followed by a memory number will put you into the priority mode, where a predetermined frequency is regularly checked while you're on another one.

Special features

The FT-727R was unique in that it was able to give a reading of the instantaneous battery voltage to the nearest half volt. Using the function switch and a keypad press displays the voltage on the LCD panel. In conjunction with the red battery warning LED, it is a simple matter to avoid fading off into low battery oblivion while transmitting.

The VOX on-off switch on the top panel allows you to use a useful Yaesu accessory, the YH-2 VOX headset. This accessory did not come with the radio but could (and still can) be purchased at nominal cost. The headset is very light. It has one foam-covered earpad and a very light foam-covered mike on a flexible boom. It plugs into the EAR and MIC plugs on the top deck. I have found this accessory to be extremely useful while traveling bicycle mobile. It can only be used while the rig is in VOX mode and, of course, the usual care must be exercised about what is said while in the VOX mode. Slips of the lip can cause unwanted transmissions to go out over the airwaves!

A half duplex situation can be entered by holding the function key and pressing the DUP key. In this condition, you can transmit on one band and receive on the other. In certain situations this can be a useful feature.

In use

I purchased my FT-727R in May 1988 and have been using it ever since. It has at times been used as a mobile rig connected into the vehicle's electrical system through a home-brew adapter. Most often a 5/8-wave mag mount was used for the mobile. Most of the time was spent in a rural area of western Montana, doing rag chewing, "meaningful communication," and autopatching. In the absence of a base station rig it has been used in that capacity also, connected to a 30A station power supply or storage battery and the two-meter J-pole mounted on the roof. In that case, there wasn't much I couldn't do with the radio set at 0.5W. As I indicated earlier, it is used also in the bicycle mobile mode. Using either the FNB-4A battery or a small gel cell, it is carried in a handlebar bag with the rubber ducky protruding. The VOX headset is worn under the helmet and the rig placed in the VOX mode for operating hands-free while riding.

Options and accessories

After I had been using the radio for over five years, I decided it would be advantageous to add CTCSS tone encode and decode capability. I purchased the Yaesu FTS-6 tone unit and did the simple installation. It worked right out of the box and provides the ability to use "toned" repeaters that I could not previously use. The control keys are provided on the radio but do not function until the unit is installed. Also, the icon on the LCD panel then becomes activated.

Early on, I unthinkingly left the radio lying on the bed where our family cat, Spot, normally sleeps. She enjoyed chewing the end off the original equipment rubber ducky antenna. I ordered a very similar-appearing replacement dual-band ducky made by Larsen and used it successfully. Later, I came across another Yaesu YHA-27 original equipment ducky and compared it with the Larsen in everyday use. The Larsen is superior on both bands.

An accessory that I purchased and must recommend very highly is the HT carrier called The Pouch. It is made of wetsuit material. The makers do an excellent job of stitching it up, and mine is like new after almost seven years of use. It has a belt loop and a cover that is secured with hook and loop attachments. The rig has fallen several times while enclosed in the protective Pouch, without suffering any nicks or damage.

The 36mm speaker mounted in the 727 case does a pretty good job in most situations. I purchased a Radio Shack™ CB-type extension speaker and mounted it in my car. When the FT-727R was doing duty as a mobile rig, I plugged the speaker cable into the EAR jack and let the 450mW of audio power drive the larger speaker for better quality.

Summing it up

Not all of the falls took place while the rig was safely enclosed in its protective cocoon. As an artist, I often carry a lot of stuff around to various places and am not always careful about some of my armloads. On one occasion, while loading the car, the HT slipped out from under my arm and fell from above waist level to the hard ground. It landed squarely on the ends of the squelch and volume controls, with the result that the squelch pot was broken and inoperative. I returned it to Yaesu for repairs. By the time it was returned, I had purchased the aforementioned Pouch, which I have used since. I invariably hook my middle finger through the belt loop of the Pouch and secure the top strap. That way, even though my arms are full, the rig cannot fall.

"A real rock in terms of reliability."

I am still using the original FNB-4A battery that came with the radio. I have simply followed the NiCd commandment of using the battery until it becomes inoperative because of low state of charge and then recharging it fully.

All in all, this HT is a real rock in terms of reliability. Its double conversion superhet receiver works well; its transmitter power is more than adequate for most repeater situations on both 2m and 70cm; it is easy to use and generally does the job. If you want an all-purpose, dual-band FM radio and want to save $150 to $200 over the purchase of a new one, look for a good used Yaesu FT-727R in the ads or at the next hamfest. 73

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LETTERS

Continued from page 55

Richard Ebeling K2UTC, White Plains NY. My purpose for writing to you is to offer a suggestion pertaining to your editorials. I am not a subscriber to *73* Magazine, but occasionally read *73* via a borrowed copy.

First, your editorials are very interesting, and informative; that is, there are articles/comments that I read nowhere else. My only criticism is to reduce the number of continuing pages that one has to turn to in order to follow your thoughts. April 1997 *73* is an example. Starting from page 4, then page 38, 47, 59, 61, 65, 81, 83, 88, etc. To me that is very distracting, plus it makes it more difficult to keep the entire editorial. I do not think I am the only one to ask why so many multiple pages, but generally everything has a reason.

Secondly, I have an observation/statement regarding our beloved 10-meter band. Are you aware of the "dangers" of operating 10 meters? Probably that is not the right word to describe the "non-amateur mess" our band is in with commercial intruders, CB trespassers, and pirates of varied descriptions. One needs an up-to-date list of legal amateur radio prefixes handy. For more than one year here in the New York City area, we have a renewed NYC taxicab commercial intrusion on 10 meters.

Thinking back to the 1985-86 NYC taxicab invasion, it was almost unbelievable. At least the taxicabs do not attempt to break in on a 10-meter amateur QSO like thousands of CB trespassers and other misguided individuals were doing during sunspot cycle 22. Nothing compared to the "mass invasion of European CBers" primarily from Italy, Spain, France, and other assorted countries across almost all of the 10-meter band, operating in AM, FM, and SSB mode.

Just yesterday, with DX skip appearing on 10 meters, already the intruders/trespassers are being heard, so with sunspot cycle 23 just starting, the 10-meter band will be a "challenge" as regards how many legally licensed amateurs are going to be drawn into radio contacts with all that non-amateur trash. To repeat, have an up-to-date list of all legal amateur radio prefixes (domestic and foreign) handy.

To someone like myself, who has operated 10 meters continuously since sunspot cycle 19 (through maximum and minimum sunspots), it is discouraging to observe what has happened to a decent amateur radio band since the "FCC 11-meter Pandora's Box."

Well, to 10-meter beginners and old-timers alike: Be advised that it would be prudent to exercise a little caution when making a radio contact, as many amateurs were completely fooled by non-amateur trash during cycle 22. 73

THE DIGITAL PORT

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Resolving the Windows 95® comm port problem

Do you ever feel as if you're alone in a wilderness of computer problems? It gets serious when your computer can't talk to your TNC. The computer I am sitting in front of right now nearly got the best of me this past month. Logic wasn't failing; it was just requiring such a huge volume of input to gain so little.

Let me start at the beginning. This computer has served me well for over five years with only a few major problems—such as the evening Windows 3.1® ate itself and the time I replaced the once-magnificent 105Mb hard drive and the tape backup lost a few necessary items in the transfer to the new 800Mb drive.

About a month ago, the bugs beat down the door to their cage and a good working computer descended to the depths where even I was unable to help. The clue was when the floppy drives and the serial port for the TNC would not respond except after I wiggled the driver board. The final blow came when the wiggling process ceased to cure the problem and the parallel printer ports quit.

I called the local computer guru, and prepared a list of problems along with a list of what I would like to have done about them while I was gone for a week. Fortunately, when they called to tell me the first logical answer was to erase the hard drive, I was still in town. It is quite exciting to a person like myself when a tech wants to destroy the "irreplaceable" files, not to mention numerous excellent, use-every-day programs.

So, when I returned, the unit was nearly ready to pick up. There was a new hard drive, with the golden files copied to one partition, and a nearly empty partition for me to fill as I saw fit, along with a new motherboard, Pentium processor and a whiz-bang modem. The old hard drive was still mounted "just in case something hadn't copied."

What can go wrong will ...

Now about the Law ascribed to Murphy. I do a lot of work that requires a modem to the telephone line as well as using the PK232 MBX. That means comm 2 and comm 4 both need to work. You guessed it. Those who are up on interrupt requests (IRQ) realize that these ports use the same IRQ. In the past, it was necessary to exit the program on one port so the other port could be recognized.

No matter how I explained to this machine that "it used to work," there was no understanding of my dilemma. A call to the computer shop revealed that the model of US Robotics modem they installed was "plug and play," which is Windows 95 for "we'll configure it our way"—and I didn't have a voice in the matter. The answer was a modem from the same company with some jumpers that allowed me to set it for comm 4.

I am one of the classic holdouts who kept Windows 3.1 just a few years longer than expected. It was hard enough to give up DOS. There are some figures, recently published, that show about half of the folks think much the same as I do about changing to the new operating system. Many changed back to 3.1 after a trial run.

In defense of Windows 95, once you get it working, everything runs much faster. I have quite a few 16-bit programs that really run well and faster now that they can take full advantage of the processor. Some programs just had to be replaced. The backup software for the tape drive had no clue what it was reading, but the new package makes the same drive perform at least three times faster.

Back to the problem ...

A ham, especially a digitally-minded ham, has got to do what he's got to do. With the ports straightened out, I couldn't get the AEA Packratt for Windows program to access the PK232 MBX plugged into comm 2. The problem looked similar to when the port couldn't be found.

Follow the logical trail

How do I determine the difference between a software problem and a hardware problem? Answer: substitution. I tried the copy of Winpack v6. It would give a glimmer of hope and then fail. Next was the DOS program I referred to last month. It came up all right, but couldn't talk to the PK232 at all.

Maybe this is a problem with the PK232? I have a now ancient 386 with only DOS (kind of nostalgic) that works, but the logistics (cable length) put it out of reach of the PK232. Out of the garage came the MFJ 1274. With that hooked to the 386 and the DOS program installed, the two pieces of hardware communicated fluently. That at least proved one piece of software worked like it was supposed to.

The idea of moving the 386 computer and the PK232 within cable distance of each other was a little daunting. Perhaps the answer was software. Maybe the old package I was using so well for several years just wouldn't work with the 32-bit architecture. Back to the logic seat.

I had noticed recently there was some great sounding shareware available. There is a copy in the Hamnet library on CompuServe, but I wanted a little information. I hunted down the XPWare site on the Internet and read through the claims. There were screen shots of the program in action and a DOS version as well as one for Windows 95.

The descriptions convinced me I had to give it a try, so I downloaded the Windows version and installed it. The program ran, looked very stable and seemed friendly enough, but when I attempted to connect to the PK232 MBX, it spent several minutes identifying the TNC, then locked up ...

Yuk. It looked so promising, yet I had not made perceptible headway.

I looked through the User's Guide I had printed out and found that Gary Johnson KF7XP not only had his name displayed but also several ways to contact him. I chose the E-mail address and told him an abbreviated version of what I just told you. He got right back to me with a few ideas.

After configuring the program for dumb terminal mode, as suggested by Gary, the program came up and talked to the PK232 MBX like they were old friends. After quite a bit of experimenting with this and other configurations, I was beginning to feel better about the hardware, but things still weren't nearly right.

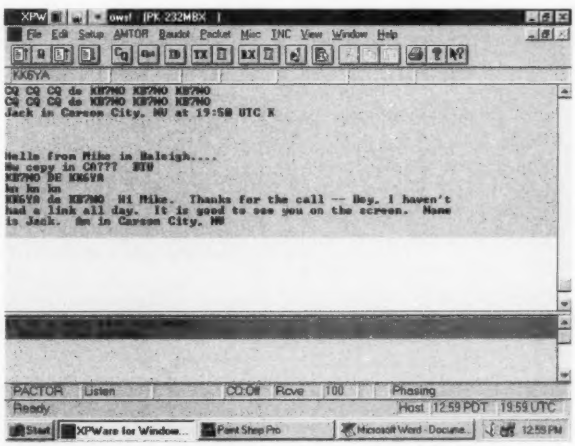
XPW owl [PK-232MBX]
File Edit Setup AMTOR Baudot Packet Misc TNC View Window Help
KK6YA
CQ CQ CQ de KB7NO KB7NO KB7NO
CQ CQ CQ de KB7NO KB7NO KB7NO
Jack in Carson City, NV at 19:58 UTC K
Hello from Mike in Raleigh....
Hw copy in CA??? BTU
KB7NO DE KK6YA
kn kn kn
KK6YA de KB7NO Hi Mike. Thanks for the call -- Boy, I haven't had a link all day. It is good to see you on the screen. Name is Jack. Am in Carson City, NV
PACTOR Listen CO:Off Rcve 100 Phasing
Ready Host 12:59 PDT 19:59 UTC
Start XPWare for Window... Paint Shop Pro Microsoft Word - Docume... 12:59 PM

Photo A. *Screen shot. This is XPWare in action. Actually, this was a day where S-meter readings were barely perceptible. I had sent CQ on 14.077kHz and Mike KK6YA answered. Due to conditions, the total of the QSO shows on the screen. The link dropped before the content of the lower (transmit) screen was sent. Note that Mike's callsign automatically appears in upper left. A pop-up log comes up with the automatic entries in it, but it didn't capture.*

Remembering there was a DOS version of the XPWare on the Internet site, I went back and downloaded that program. I had resolved that it would be worth it to move the furniture around in the shack and try an all-mode DOS program from a DOS machine. If it was going to work, this should do the trick.

When it was time to transport the program to the 386 machine, I got lazy again. It was easy to install in this machine and it came up and spoke fluently to the PK232 MBX—so much so that after a bit of fumbling with the new-to-me commands I made a PACTOR link with Doc, in Chicago (during the heat of the moment, I didn't take proper advantage of the automatic logging and the callsign is not with me). The signal strength was in the just barely range at both ends and the link seemed flawless for several minutes. I felt like I had a new toy!

A hero arrives

So I sent Gary another E-mail. It was late afternoon and after dinner I went back to checking this program, printing the 100-page user manual (I was really getting impressed with this DOS program) and tinkering with the packet parameters. About 9:30 the phone rang and here was Gary introducing himself. He was going to make this thing work. Though this wasn't the strangest happening in this long course of events, I was sure I had tried the settings Gary outlined. But when it works, I'll admit to almost anything.

You just can't ask for much better service. There was some conversation about what I had observed since the last E-mail. Then he just simply led me along the path I should have been traveling and suddenly the program all fell into place. The host mode worked and I was a very relieved and happy camper.

A mini-review of XPWare

For a quick review of the impressive features of the Windows version of XPWare, let me begin with how the program comes up with the PK232 MBX plugged into the serial port. On the screen, you can see it takes about 15 to 20 seconds to scan and identify the machine, then it not only displays PK232 MBX but also the latest version of ROM by date. There are a number of other AEA controllers, so the program needs to know precisely which one it is working with.

When the operating screen is up, you see a familiar Windows format with the various available modes, Amtor, Baud, and Packet, that will allow changing modes and forcing transmit and receive functions by the logical pull-down menu methods. It is a nice, neat, straightforward layout that includes a setup menu, along with menus for editing text, handling files and excellent on-line help.

As with any thoughtfully designed program, there are ample shortcut keys so the mouse is not mandatory for most operations such as making connections, changing modes, turning the transmit back to the other station, etc. But—a good operating mouse is useful.

XPWare comes with automatic formatting for the various modes to do such things as call "CQ." If you take a look at the screen shot (**Photo A**), the CQ sequence was the result of a mouse click (you can substitute F5) on the CQ button in the tool bar. If there is no linkup, the program causes a 45-second receive time and then repeats the CQ sequence. This is set for five complete cycles and you can stop it at any time. All this was ready to go as soon as the program was up and running—nothing to read, no codes to insert, just sit down and play.

Somebody said recently that if a program isn't intuitive enough to be run using the help screens, it is just plain bad software. XPWare, therefore, qualifies as good software by that criterion.

I happen to enjoy PACTOR, so that is most of what I have done since it came up running a few days ago, but I see that just about everything that applies to one mode goes for the others. I noticed, to my surprise, that when I connected to the local packet node, a sweet feminine voice came on and not only told me that I was connected, but also gave the callsign in phonetics. The same thing occurs with a PACTOR link.

Is the comm port problem resolved?

Possibly the strangest thing in all this is that which I have been told is impossible has occurred. Remember how the comm 2 and comm 4 cannot have the same IRQ and be opened at the same time? Well, these two ports have IRQ 3 like they are supposed to, and I can have comm 2 opened with XPWare, and connect to the phone line with my modem on comm 4! Honest. No tricks involved. Don't ask me to duplicate the magic. The wife has told me all along there is a strange virus in this room. I think I will have to join her method of reasoning. It is about as logical as anything that has happened during the past week in this little room where I escape from the realities of life.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line at [KB7NO@N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO. 73

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the October issue, we should receive it by July 31. Provide a clear, concise summary of the essential details about your Special Event.

JULY 4

DILLSBURG, PA The Harrisburg ARC will hold its Firecracker Hamfest 8 a.m.–2 p.m. at the Monagahan Fire Hall, 245 W. Siddonsburg Rd., Dillsburg PA. VE exams start at 9 a.m. Talk-in on 146.16/.76 MHz. For info and table reservations *phone the HRAC AnswerLine at (717) 232-6087.*

JULY 5

MILTON, ONTARIO, CANADA The 23rd Annual Ontario Hamfest® will be sponsored by the Burlington ARC, at Milton Fairgrounds. Gates open 7 a.m. to commercial vendors (Robert St. gate only), 8 a.m. to tailgaters (Robert St. gate only), and 9 a.m. to the public (Thomas St. gate only). Adm: $5 per person; tailgate parking $2 per vehicle. The CLARA Annual Picnic Meeting starts at 11:30 a.m. Weekend camping $10 per site. Talk-in on VE3RSB 147.21 and simplex 146.52. Contact *Burlington ARC, P.O. Box 85037, Burlington Ontario L7R 4K3 Canada; or [ww.bigwave.ca/~jefdavis/barc/]. Or contact Jeff VE3COJ, (905) 335-4862; E-mail: [jefdavis@bigwave.ca].*

SALISBURY, NC The North Carolina Alligators Group "Firecracker Hamfest" will be held at the Salisbury Civic Center, 8 a.m.–1 p.m. Admission is $3 in advance (with an SASE), or $4 at the door. Free to XYLs. Auction of goods will be at 1 p.m. Dealer setup at 6 a.m. Tables in the air-conditioned center are $5. Outside flea market spaces are free. Contact *Walter (Alligator) Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071.* Talk-in on 146.625. Directions: From I-85, take Hwy. #52 West/East Innes St., turn left on South Boundary St. The hamfest is on the left.

JULY 10 & 24

FT. WORTH, TX The Lockheed ARC and the Kilocycle Club of Ft. Worth TX, will sponsor test sessions for all classes of licenses. They will be held at the Lockheed Recreation Area facility, 2400 Bryant Irvin Rd., starting at 7 p.m. G.R.O.L. testing by appointment only. For info call *Ted Richard AB5QU, (817) 293-6745.*

JULY 12

OAK CREEK, WI The South Milwaukee ARC, Inc., will hold its 28th annual "Swapfest" on Sat., July 12th, at the American Legion Post #434 grounds, 9327 S. Shepard Ave., 7 a.m. until at least 2 p.m. CDT. Free parking, picnic area, and free overnight camping are available. Admission, $5 per person includes "Happy Time" with free

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RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153

I don't know what's more striking to me, that this column now begins its twenty-first year, or that my son, born the year I started this column, will soon mark the same milestone. And I'm not that old, even though I qualified for the QCWA almost ten years ago!

Through it all, as I have said countless times, it has been you, the readership of *73 Magazine* and this column, who have taken me through good times and bad. It is through you, and with your help, that I am able to maintain the breadth of material in RTTY Loop, covering everything from greasy old Model 15s to the latest Windows 95-based digital programs. Those of you who have been reading these pages for a while know that it was in this column that many of you first saw the Epson MX-80 printer, one of the first dot matrix printers to hit the consumer market, as well as tales of 6800, 6502, and 6809 microprocessors back in the eight-bit days.

Well, with that bit of nostalgia, let's see what readers of mid-1997 are discussing. Paul Cecil KA5FPT/DA2PC, in Kaiserslautern, Germany, the largest US military community outside the United States, offers his comment about the Pakratt program. He says that he, too, has the PK-232MBX and Pakratt II 5.5, with PACTOR. But, looking over everything, he realized that, "It is actually calling up a separate program. All that the 5.5 upgrade did was to add PACTOR to the menu, among some other things. I hope that this answers some questions."

Thanks, Paul. I receive a variety of questions on the various programs, and its always good to hear one ham's experience.

With a problem solved, comes a problem presented. Doug VE6IT passes along this problem:

"I inherited a DRSI HF modem and the VHF packet adapter. However, no documentation came with either unit. I was wondering if you knew anything about these units, including connections and software I could use to put them in service. I regularly read your articles and find them great."

Doug, I have less than you—at least you have the unit! Will pass it along, though, as you never know what someone might have in a basement drawer.

After those two meaningful letters, here's a lighter note, from Robert E. Pearson W9KKL, who flatters me with the following:

"Just a short note: I think I have read every word you have written in *73 Magazine*. I used to borrow a friend of mine's *73* from about 1973 to about 1976. They lowered the price about that time, and I started taking it, and have ever since. Back then I was really broke. Although I myself do not play RTTY now, I used to. The Internet sort of takes my time. I have a PK-232, HAL CT-2200, and an old Model 19.

"I really like your home page, the greeting, and everything. I have one comment, please add your picture and perhaps your rig to your home page."

With space on my server at a premium, I am sure that my fans would rather have a RTTY program to download than see my punim, but I'll give it some thought. That greeting Bob refers to, by the way, is a little clip of my voice welcoming you to the page. Check the address of the RTTY Loop Home Page below, and if you've not checked it out recently, have a look. Thanks for the strokes, Bob, and I'll try to live up to it all!

Last month I detailed some of the problems faced by amateurs using AEA equipment, pending the restoration of commercial support. S. Neil Xenias N4CTB passes along the following bit of wisdom:

"I really enjoyed your column in the March issue. I, too, am saddened by what happened to AEA (you can guess which multimode controller I own!). I wanted to offer some help to your readers which may or may not be fruitful. Here in Virginia, many of the Army MARS members use the PACTOR mode to handle MARS traffic. A large percentage of these folks use the AEA PK-232.

"The MARS group here has a 'Technical Librarian' who maintains copies of technical manuals, equipment conversion info, and most recently, EPROM listings. If your reader(s) in need can hook up with a local MARS member in their town, chances are that they can get a set of EPROMS burned for them. 'Course, they'll probably get the recruitment pitch, but we need all the members we can get—HI!"

As a former member of a MARS program, quite active during the 1970s, I can vouch for the thoroughness of the system. For those not familiar with the Military Affiliate Radio System, this is a volunteer civilian organization which acts to support members of the armed forces throughout the world. During the Vietnam war, for example, I spent many nights and weekends handling message traffic between soldiers in the field and their families at home. So, if they can help you, don't be shy about looking into helping them. They can use you, and you'll feel good for doing it.

On the RTTY Loop Home Page, I have a program called A2FTerm, an Apple II RTTY program, with a request for comments. Since I get a fair number of requests for Apple RTTY programs, let me pass along what Paul N5YFK has to say about it:

"It is a workable Apple II program—in fact, considering the old 6502 computer chip and the instruction set, a very good program. (I started off programming in 6502 machine language for the Apple II.) A very nice feature is that it will run on a system with a single disk drive. It can be downloaded to a PC, and then transferred over to an Apple with some ease. If each computer (PC & Apple) has a modem, all you have to do is connect them with a phone cord, have one on standby (i.e., ATA in Hayes lingo) and just dial a single digit with the other. The one on standby will pick up the phone and you have communication between the two. Download the file from the PC to the Apple and save to disk. That's all. If you don't have them both at the same location, a local phone call will do.

"The only real problem with some Apple files is that they are compressed, and just plain unusable unless you have a big Apple system with a hard drive and that particular version (often obsolete, abandoned, and nowhere to be found) of the compression program. So support the Apple II, but in uncompressed programs—after all, they really are small by today's standards.

"I appreciate the program—as I have still have 3 working Apples, one of which I lend out to persons wanting to try packet along with an older MFJ TNC."

Thanks, Paul, for that look at an older, but still quite usable, program. I know that there are those who would like this program, which is on Disk #7 of the RTTY Loop Disk Collection, albeit on a PC-formatted disk.

From an older program to a newer one, Stan Huntting KFØIA, passes along the following notice about a program for Kantronics TNCs:

"As a computer-literate amateur radio operator, there's an excellent chance you're active on one or more of the 'digital' modes, and that you use Kantronics TNCs in that activity. Also, as an Internet-connected amateur radio operator, there's an equally good chance you use MS Windows and a fast computer. If so, you should know about KaWin—the performance-enhancing software designed especially for Kantronics TNCs and MS Windows. Visit the KaWin home page, at [http://www.mutadv.com/kawin] (Keyword to:) to learn more and to download the full KaWin system to try it on your own system.

"KaWin supports all TNC communication modes, including VHF and HF packet radio; CW, RTTY, ASCII and Navtex; Amtor, PACTOR, G-Tor, Tor-standby and G-Tor Monitor. Its Host mode interface means KaWin and your TNCs communicate computer-to-computer with full use of your

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

More video recording

For the past several months, we've been exploring television: its history, signals and manipulation. I realize the topic of video recording isn't strictly ham-oriented, but video is, more and more, a part of the radio experience, and an understanding of it can only enhance your ham radio fun, especially if you're interested in SSTV or ATV.

Last month, we took a look at the first practical video recorder, the quadruplex VTR, designed for broadcast use. If you've ever been in the control room of a TV station, you've probably seen one of those behemoths. The high-pitched whine the headwheel makes is not easily forgotten! Quad VTRs were incredibly complicated, and, as I mentioned last time, never filtered down to the home-use level.

A home video recorder was the "holy grail" of the electronics industry for a good twenty years. Anyone with some foresight knew such a product would be a smash hit, perhaps as big as television itself, and everyone wanted to be lead dog in that race—so why did it take so long to finally happen?

Not easy

As we explored last time, there were many obstacles to recording a video signal, at any price level. And certainly, no home user could afford a tape recorder that cost more than his house! Was there any way to make an affordable home video recorder? Until about 1970, the answer seemed to be "no." Many companies tried all kinds of ways to bring the cost of video recording down, giving up, one by one, as they encountered technical hurdles that couldn't be solved at the price levels necessary for home use. RCA was a pioneer in this area, and spent millions of dollars researching the "HVTR," as they called it. Yet, the company finally announced, around 1972, as I recall, that "it just can't be done," and abandoned the project. Of course, it *was* done, slowly but surely. Here's how:

A different beast

In the early 1960s, Sony, Matsushita (Panasonic), Toshiba and other Japanese companies had begun to introduce non-broadcast-quality machines in the $2,000 range. At first, they were black-and-white only, as no one had yet solved the timing problems required for color recording. These machines used the "helical scan" principle. Like quad machines, they had spinning heads and employed FM recording. But that's where the similarity pretty much ended.

Quad machines used a very high head-to-tape speed of 1,500 inches per second, recorded on two-inch-wide tape, and laid down tracks which were nearly perpendicular to the tape travel. That resulted in a short track (no longer than the width of the tape), so it took several head sweeps to make one TV field. That required very tight servo control of the headwheel, so that the signal disruptions, inevitable as one head left the tape and the next one made contact, occurred in portions of the signal which were not visible on the screen! Even worse, the long-lasting but brittle ferrite material that would give long service life could not be used for the heads, because the sideways motion of the tape against the heads would break it—so quad heads wore out fast.

The helical concept, so named because the diagonal wrap of the tape around the head drum looks like a helix (if it wraps all the way around, which modern machines don't), had been tried by Ampex but discarded as unsuitable for broadcast use. For less critical applications, though, it had tremendous advantages, along with a few disadvantages. The diagonal wrap resulted in long, diagonal tracks on the tape, whose length was limited only by the circumference of the drum, rather than the tape width. Consequently, narrower tapes could be used, and one-inch, three-quarter-inch and one-half-inch machines were common. Plus, those long tracks meant that an entire TV field could be recorded in one head sweep, vastly simplifying the servo required to control the head motor, and easily keeping the signal disruption (called the "head switching point") out of the picture, near the vertical sync. Another great benefit was that, since the tape direction and direction of the head scan were at a fairly close angle, there was very little sideways stress on the heads, so ferrite could be used. Coupled with advances in tape manufacture that made for much smoother tapes, and a slower scanning speed (because broadcast-quality bandwidth wasn't needed), headwear was finally reasonable, even though the scanning speed was still over 300 inches per second. Now, expensive video heads could last for thousands of hours, rather than hundreds.

This sounds like such a great system—why couldn't the broadcast machines use it? Unfortunately, it had some serious disadvantages as well. The first was that, in order to wrap the tape diagonally, it had to be pulled out of its normal plane of motion. You could do that, but it required some cone-shaped guides, and the tape motion wasn't terribly stable. Plus, the much larger mass of the head drum meant you couldn't servo-control it very fast, so ultra-tight edit timing, so necessary in the broadcast world, wasn't possible. But perhaps the biggest disadvantage to helical scanning was its generally poor timebase stability. In other words, the timing of the signal wobbled too much for broadcast use. By law, broadcasters must meet some very strict signal standards, and no helical machine could even approach them. Wobbly timing means wobbly pictures, and that just wasn't tolerable in a TV station.

In non-broadcast applications, though, some timebase error could easily be tolerated. Helical machines were quickly accepted in educational and corporate markets. Institutions and businesses could afford to spend a few thousand dollars on TV equipment, and that market opened the gate for development of the home video recorder. The race was on!

More obstacles

So, if machines could be made to sell for $2,000, why not just make lots of them, so that the economy of mass production would bring the cost down? After all, we see that today in many initially expensive products, like computers. Alas, video recorders are fundamentally different from most other high-tech products: they're intensely mechanical, rather than mostly electronic. It's easy to mass-produce circuit boards, but not highly precise mechanical assemblies. Video

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dual-port TNCs and simultaneous multiple TNCs, multiple ports, multiple streams and multiple radios.

"KaWin is a native MS Windows program with a no-compromise design for 486 and Pentium systems. Looks like, feels like and talks to your other Windows applications with fully event-driven communications. Intuitive menus, full mouse support and on-line help make KaWin is easy to learn. Quick keys, Quick connects, Brag files, CQ robot, restartable binary file transfers, ANSI graphics and much more."

This is a nice program, which can be downloaded in a "try before you buy" arrangement. Thanks to Stan for passing along the information.

Check out the RTTY Loop Home Page for all that I mentioned above, and more stuff as well, at [http://www2.ari.net/ajr/rtty/]. Let me hear from you by snailmail at the post office box address above, or by E-mail at [ajr@ari.net], on America Online at [Marc WA3AJR], or on CompuServe via the new address, [Leavey@compuserve.com]. Next month, more on new RTTY programs, old RTTY pictures, and crazy RTTY users. 73

CARR'S CORNER

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Safety first: some antenna erection guidelines

One reader once wrote and took me to task for saying too much about safety. He claimed that interest in safety is minimal, and that everything regarding safety is (his words) "intuitively obvious to even brain-dead idiots." I most respectfully disagree. Safety is not a "given," especially where antennas are concerned.

Antennas are inherently dangerous to erect if certain precautions are not followed. It's impossible to foresee *all* the situations that you might face in erecting an antenna. I would like to give you all possible warnings, but that isn't possible. You're on your own, and must take your own responsibility when installing an antenna. I can, however, give you some general safety guidelines. Knowledge of what you face, some hard-nosed sound judgment, modulated by common sense, are the best tools on any antenna job.

One rule that is an absolute is that no antenna should ever be erected where the antenna, the feedline or any part thereof crosses over a power line. EVER! This is a "no kidder"—don't do it! Power lines look insulated, but there are often small breaks or weakened spots (especially a couple days or more after installation) that can bring the antenna into contact—lethal contact—with the hot power line. Every year or so we hear about an SWL, scanner/monitor buff or ham radio operator being killed by tossing an antenna wire over a power line. Avoid making yourself into a high power resistor!

The same rule applies to situations where the antenna can fall onto a power line if it falls down or breaks. You have to examine the situation with a critical eye to see if there is any possible way for that antenna, or its support structure, to fall onto a power line if it breaks in any way whatsoever. On my lot in Virginia I have a 23-foot mast erected on the back of the house. When I installed it I made a scale drawing of the back yard showing the path of the power line. The 23-foot fall radius of the antenna was plotted for several possible antenna locations. It should not intersect either the power lines or the cable TV line when it falls. It should also not be in a position to fall over a pedestrian path, a place where children play, or across a public walkway or street (lawsuits are messy). Or as one chap found out the hard way, it should not be in a position to fall through a window!

Another caution is that you should be physically fit to do the work. While the on-the-ground portion of the work is not usually too strenuous, any climbing at all, even on ladders, can be taxing for some people. Antenna materials are deceptively lightweight on the ground, but when you get up on even a small ladder, they are remarkably difficult to handle. Attempting to manhandle a 22-foot vertical once wiped my back out, and I consider myself fortunate that the pain hit me after I'd dismounted the ladder. Besides, if you could see me, you would wonder why a man my size was on any ladder in the first place. Before using a ladder, learn *how* to use a ladder. A lot of homeowners, whether putting up antennas or painting the upstairs windows, fall off ladders that were being used incorrectly.

If the wind blows even a few miles per hour, the danger is magnified considerably. I recall a friend—who is a large, strong bear of a man—attempting to install a 26-element television "all channel" antenna on the roof of his two-story house. The antenna was easily handled with one hand on the ground and with no wind blowing, but up on the roof it was a different story. He was on the peak of the roof, when a gust of wind came up suddenly and caught the antenna. It acted like a hang glider, and pulled him off the roof, plunging down two stories to the patio below; he fractured his pelvis and busted a leg. Expensive TV antenna, I reckon. *Be careful*.

One good rule is to always work under the buddy system. Ask as many friends as are needed to do the job safely, and always have at least one assistant even when you think you can do it alone. Erecting a large antenna—and some small ones—without help is just plain stupid. At least have someone around who can call 911 if you mess up.

Always use quality materials and use good work practices. Antennas, being potentially dangerous, should always have the best of both goods and workmanship in order to keep quality high. It is not just the electrical or radio reception workings that are important, but also the ability to stay up in the air and safe.

When planning the antenna job, keep in mind that pedestrian traffic in your yard could possibly affect the antenna system. Wires are difficult to see, and if an antenna wire is low enough to intersect with someone's body, then it is possible to cause serious injury to passersby. Saboteurs and the Resistance used to knock Nazi motorcyclists off their bikes (and to their doom) using a bit of wire stretched across the road. Even when the person is a trespasser, the courts may hold you liable for injuries caused by an inappropriately designed and installed antenna. Take care for safety, not only for yourself, but for others.

One necessary reminder is that

---

heads had to be positioned on the drum by hand, under a microscope, to a tolerance of a couple of microns, in all three dimensions—and the roundness of the drum itself had to be within about five microns, or interchange of tapes between machines would be unusable. Also, by the time serious development was underway, there was one very tricky requirement that industry was willing to do without, but home users never would: color. Although the technical issue had been solved by the early 1970s, and color machines were available to industry, the cost of color recording was still too high for home use. Worst of all, the industrial machines still consumed too much tape per hour of programming, and manufacturing videotape wasn't cheap.

Although today we take $2 videocassettes for granted, it wasn't always like that! Not so long ago, those same tapes were $18. Reel-to-reel videotape cost about $25 per hour in the 1970s, and that was when money was worth much more. The cost per hour of tape was, perhaps, the biggest obstacle of them all.

Here it comes

In an effort to reduce tape consumption, various schemes were tried. One that actually appeared in some industrial machines was to record only every other field of the TV signal, and play the same field back twice. Called "skip field" recording, it reduced tape consumption by 50%, but it resulted in a loss of vertical detail of the picture by the same amount. Worse, it often caused jumpy, jittery pictures. Sony's CV-2000 and other mid-1960s machines used the technique, but it was no real solution.

Eventually, a Japanese standard called EIAJ (Electronics Industry Association of Japan) was agreed upon. This format used half-inch tape at seven and a half inches per second, and recorded all the fields. Tapes made on an EIAJ machine could be played on any other, regardless of manufacturer. EIAJ units were very popular in universities and early cable TV channels. Eventually, an EIAJ-2 format was created for color recording, but it was soon eclipsed by a great advance in helical technology which drastically reduced tape consumption, thereby beginning the onslaught of the home video formats. At last, true home video recording was coming.

Next time, we'll explore the modern VCR: how it came to be, how it works, the sweeping effect its creation has had on the manufacturing and development of other products, and why it's so cheap today. The grail is just around the corner...

Until next month, 73 de KB1UM. 73

your local government might have some interesting ideas—legal requirements actually—concerning your antenna installation. The electrical, mechanical and zoning codes must be observed. There is a great deal of similarity between local codes because most of them are adaptations from certain national standards. But there are enough differences that one needs to consult local authorities. Indeed, you may need a license or building permit to install the antenna in the first place.

One problem that SWLs and scanner monitors face is that their antennas are not protected by the FCC as are ham antennas (local governments have limited rights to regulate ham antennas; only "reasonable" mechanical and electrical standards can be imposed), so it may be illegal for you to install *any* antenna. About 30 years ago a friend of mine in a radio club found out that his county had an ordinance that said an outdoor antenna must be double its own height plus fifty feet from the nearest property line. He received a summons after a complaint from a neighbor. In a county full of quarter-acre home lots, however, that was a ridiculous law. Very few outdoor TV antennas met that strict requirement! So Hal went to the court house and asked for 50,000 complaint forms. Using a local county directory, he proceeded to file the same complaint as he'd received against every homeowner in the area. The county board repealed the law during the next meeting.

Save all paperwork regarding your building permit, including inspection decals or papers, and the original drawings (with the local building inspector's stamps). If a casualty occurs, then your insurance company may elect not to pay off if you have violated an electrical, mechanical, building or zoning code. That clause may be overlooked by an enthusiastic antenna builder, but it could prove to be a costly oversight.

If you think this commonsense information is "too much" about antenna safety, then I will certainly be praying for you. Please be careful...you people are my friends and I don't like to see friends get hurt.

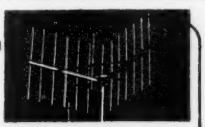
New books

Over the years a number of readers have honored me by buying my books, and for those supporters I am deeply grateful. I have recently signed to do a line of several books called the *Electronic Circuits Guidebooks*. The first one, which is on sensors and sensor interfacing, should be out about the time this article is published. The publisher is Howard W. Sams & Company/PROMPT Publishing (2647 Waterfront Parkway East Drive, Indianapolis IN 46214-2041). If you enjoyed the electronics books once published by the old Sams, and by TAB Books when they were still in Blue Ridge Summit PA, then you might want to check out the new Howard W. Sams catalog.

Those of you who have enjoyed my articles on radio and science may be interested in a new book I've just signed for with Sams on RadioScience Observing (a term I coined for all forms of scientific observation using radio receivers, including whistler hunting, radio astronomy, Jovian radio signals, radio propagation, solar eclipse observations and so forth). I am just starting to write it, so look for it early next year.

If you have any ideas to share for the radioscience book, especially if you teach science, then I would very much appreciate hearing from you. I also would enjoy receiving suggestions of any kind for this column. 73

CornerBeam?



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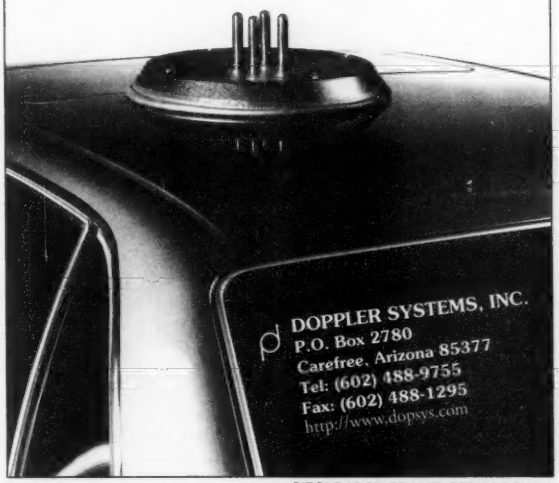

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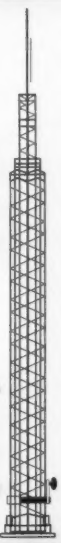

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refreshments. Free flyer by writing to *The South Milwaukee ARC, Inc., P.O. Box 102, South Milwaukee WI 53172-0102. Tel. (414) 762-3235.* Talk-in will be on 146.52 (WA9TXE) simplex as well as on many of the local repeaters.

PETOSKEY, MI The Straits Area ARC will host a Swap & Shop in the 4-H Bldg. at the Emmet County Fairgrounds. Talk-in on 146.68(-) and 146.52. Contact *Jim KC8FFS at (616) 537-2422* for details. For VE exam info, call *Floyd KG8CS at (616) 526-5503.*

JULY 12-13

INDIANAPOLIS, IN The Indianapolis Hamfest will host the ARRL Central Division Convention as well as feature a huge ham, computer, and electronics show. Marion County Fairgrounds, easy access from I-465 and I-74. Commercial exhibits, flea markets, forums, banquet, overnight camping available, home-brew contest, T-hunts, prizes, more. Write or call *Indianapolis Hamfest Association, P.O. Box 88677, Indianapolis IN 46208; tel. (317) 251-4407; [www.indyhamfest.com].*

JULY 13

KIMBERTON, PA The Mid-Atlantic ARC will sponsor an indoor/outdoor hamfest at Kimberton Fire Company Fair Grounds, Rte. 113, south of the intersection with Rte. 23., starting at 7 a.m. Tables, 1–4, $10 ea.; 5 or more, $8 ea., not including admission. Tailgating, $5. Adm. $5. Talk-in on 146.835(-) and 443.80+ PL 131.8. Contact *Bob Haase W3SA, (610) 293-1919; FAX (610) 293-7688; E-mail: [wb3joe@voicenet.com], or write to MARC, P.O. Box 352, Villanova PA 19085.*

PITTSBURGH, PA The North Hills ARC will hold their 12th annual hamfest 8 a.m.–3 p.m. at Northland Public Library, 300 Cumberland Rd. Talk-in and check-ins will be on 149.09 W3EXW, the North Hills ARC rptr. Free admission, free parking. One free automobile-sized space per tailgater; each additional space $5. The hamfest is handicap/wheelchair accessible. Contact *Bob Ferrey, Jr. N3DOK at (412) 367-2393; or via E-mail at [bferrey@nauticom.net], or through the North Hills ARC Web site at [http://nharc.pgh.pa.us].*

SUGAR GROVE, IL The Fox River Radio League annual hamfest will be held at Waubonsee Community College, Rte. 47 at Harter Rd., Sugar Grove IL. Flea Market setup Sat. at 7 p.m., Sun. 6 a.m.–8 a.m. Doors open Sun. at 8 a.m. VE Exams 10 a.m. Bring original license, copy of license and photo ID. Talk-In on 147.210(+) (PL 103.5/107.2). Contact *Diana Skube WD9API, c/o FRRL, P.O. Box 673, Batavia IL 60510. Tel. (630) 293-7485.*

JULY 19

NEWPORT, NH Sugar River Amateur Radio Festival and Flea Market will be held on the Newport Common Saturday, 8 a.m.-3 p.m. Food, tailgaters, special event station, ham radio demos, vendors, RC model helicopter demos, prizes, VE test session, flea market, more. Overnight camping Friday. Exit 8 off I91 (12 mi. east) or Exit 12 off I89 (8 mi. west) to Town Common in Newport. Talk-in on 146.76 rptr/146.52 simplex. Adm. $6 tailgaters, $10 fleamarketers, buyers FREE. Pre-registration encouraged. Contact: *Rob Boyd N1CIR, 648 Rt. 103, Sunapee NH 03782-3719; phone (603) 863-5383. Packet: N1CIR@WA1WOK.NH.*

JULY 20

AUGUSTA, NJ The Sussex County ARC's 19th Annual Hamfest will be held at the Sussex County Fairgrounds, Plains Rd., beginning at 8 a.m. Reg. is $5 per person, YL and harmonics free. Limited indoor table space $13 per table; outdoor space $10 per vender. Talk-in on 147.300 and 224.50 rptrs., and 146.52 simplex. For advance sales and info, contact *Daniel Carter N2ERH, 8 Carter Lane, Branchville NJ 07826. Tel. (201) 948-6999.*

BRUNSWICK, MD "SweatFest '97" will be held rain or shine by the Mid Atlantic DX and Repeater Assn., at the MARC Train Station. Seminars, flea market, demonstrations, commercial vendors, and an ARRL test session will be featured. Contact MADRA Sweatfest '97, 230 N. Potomac St., Suite #2B, Hagerstown MD 21740. VE exams will begin promptly at 9 a.m. (be there at 8:30 a.m.). E-mail to *[madraclub@AOL.COM],* or *[http://members.aol.com/madraclub].* Talk-in on 147.06 and 448.125.

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club will hold a tailgate electronics, computer and amateur radio Flea Market Sun., July 20th, 9 a.m.–2 p.m. at Albany and Main St., Cambridge MA. Admission $4. Sellers $10 per space at the gate, $9 in advance (includes 1 adm.). Setup at 7 a.m. For space reservations and info, call *(617) 253-3776.* Mail advance reservations before the 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725, PL 2A W1XM rptr.

VAN WERT, OH The Van Wert ARC will hold their 10th annual hamfest at Van Wert County Fairgrounds, US 127 south, 8 a.m.–3 p.m. Free parking. Overnight $10. Adm. $4. Pre-reg. for VE exams.; send SASE to *Bob High KA8IAF, 12838 Tomlinson Rd., Rockford OH 45882,* or call *(419) 795-5763.* Tables $10 (8 ft.). For table reservations, send SASE to *VWARC, P.O. Box 602, Van Wert OH 45891-0602. Tel. after 5 p.m., Bob WD8LPY, (419) 238-1877. E-mail to [barnesrl@bright.net] or [http://www.bright.net/~barnesrl/w8fy.htm].* Talk-in on 146.850/.250.

JULY 25 & 26

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor their 24th annual "Ham Holidays '97" at the Oklahoma State Fair Park (Hobbies, Arts & Crafts Bldg.), northeast of the I-40 and I-44 intersection. Doors open 5 a.m.–8 p.m. Fri., July 25th and 8 a.m.–5 p.m. Sat., July 26th. Technical and non-technical programs, fox hunt, VE exams and flea market. Pre-reg. $7, $9 at the door. Flea market tables are $10 ea. in advance, $15 ea. at the door (if available). Talk-in on 146.82. Additional info and reg. forms are available on the CORA Web site at *[www.geocities.com/heartland/7332]. Address other inquiries to Ham Holidays '97, P.O. 95942, Oklahoma City OK 73143; or E-mail [n1lpn@swbell.net].*

JULY 26

NEAR WAYNESVILLE, NC The Western Carolina ARS of Asheville NC will hold its 22nd annual hamfest 8 a.m.–4 p.m. at the Haywood County (NC) Fairgrounds. Exit 24 off Interstate 40, then south on Hwy 209 3 mi. New and used radio gear, flea market, tailgating. Adm. $4 advance, $5 at the gate. Free parking. VE exams at 2 p.m. For info, contact *Norman Harrill N4NH at (704) 253-1192. For dealer and flea market info, contact Dan Henderson N1ND at (704) 684-6339. For tickets, contact Bob Helton KS4FX, P.O. Box 1488, Asheville NC 28802. For general info, call Tommy Queen K4BNP, (704) 258-2639. Talk-in on 146.91/.76.*

JULY 27

BALTIMORE, MD The Baltimore Radio Amateur Television Soc. will sponsor the Maryland Hamfest and Computer Fest at the Timonium Fairgrounds, York Rd. off I-695, I-83. Accessible to the handicapped. Kids under 12 admitted free, adults $5. Tailgating spaces $7 each, first-come, first served. Check in for free VE exams at 8:30 a.m., pre-reg. required; call *John Creek WB3GXW after 6 p.m. at (301) 572-5124. For info and table reservations, write BRATS/P.O. Box 5915, Baltimore MD 21282. Tel. (410) 467-4634 voice or FAX. Web site [http://www.smart.net/-brats] or E-mail [brats@amart.net].*

RACINE, WI The Racine Megacycle Club will sponsor its annual Swapfest on Sun., July 27th, at the South Hills Country Club on the I-94 east frontage road between Hwy. 20 and Cty. Rd. K. Dealer setup at 6 a.m. Public access 8 a.m.–2 p.m. Talk-in on 147.87/.27. Indoor air-conditioned space at $8 per table. Tailgate space is available. Adm. $5 at the door, $4 plus SASE advance to *Racine Megacycle Club, P.O. Box 3, Racine WI 53401.* Forums, dealers, exhibits, demos, VE exams. Contact *Dave Voss WB9USI, (414) 554-7565.*

AUG 2

HOUGHTON, MI The 1997 Upper Peninsular Amateur Radio Convention, better known as the U.P. Hamfest, will be held at the City of Houghton's Dee Stadium facility, located on the downtown waterfront. Doors open to the public at 9 a.m. EDT. Vendors and persons selling equipment will have main floor access beginning at 7 a.m. EDT. Friday eve. access will also be available, although overnight storage will be at owners' risk. AC power by previous arrangement only. Tables are $6/full table, $4/half table. Contact *Roland Burgan KB8XI, (906) 482-2403; E-mail [rburgan@up.net], Packet: [KB8XI@W8YY.#UPMI.MI.US.NA]. For lodging/camping/boating info, contact Keweenaw Chamber of Commerce at 1-800-338-7982, or on the Web at [http://www.portup.com/mainstr/chamber/home.html].*

AUG 2 & 3

JACKSONVILLE, FL The 1997 ARRL National Convention will be held at the Osborn Convention Center in Jacksonville. Open to the public Sat. 9 a.m.–5 p.m.; Sun. 9 a.m.–3 p.m. The Greater Jacksonville Amateur Radio & Computer Show will host the event. Free parking in the main convention center parking lot. Setup 1 p.m.–6 p.m. Fri., Aug. 1st. Upgrade VE exams will be offered at 9 a.m. on Sun. at the convention site. A wide variety of programs and forums will be presented by ARRL staff and noted authorities of national stature. Banquet at 7 p.m. Sat. at the HQ hotel, the Jacksonville OMNI. A special rate of $69 per night is available to those mentioning the convention. Phone *(904) 355-6664 or 1-800-843-6664* for reservations. Reg. for the entire weekend is only $8, which includes parking in the main lot. For more info, visit the Web site at *[http://users.southeast.net/~jrmoore/hamfest.html], or write Greater Jacksonville Hamfest Assn., P.O. Box 27033, Jacksonville FL 32205. For swap table reservations, contact Karl Hassler N4DHG, 2767 Scott Circle, Jacksonville FL 32223, or phone (904) 268-2302. Tables are $25 ea. for the weekend. For commercial exhibitor space, contact Vern Ferris KB4VPU, 356 Aries Dr., Orange Park FL 32073. Tel. (904) 272-7250.*

AUG 3

MARSHFIELD, WI The Marshfield Area ARS will host their 6th annual Potluck Picnic and Swapfest at Wildwood Park, Marshfield WI, starting around 11 a.m. All are welcome. Talk-in on 147.180. Contact *Guy A. Boucher KF9XX, 107 West Third St., Marshfield WI 54449. Tel. (715) 384-4323. Packet: [KF9XX@W9IHW.WI.USA.NA]. E-mail: [guyboucher@tznet.com].*

PEOTONE, IL The 63rd Annual Hamfesters Hamfest will be held 6 a.m.–3 p.m. at the Will County Fairgrounds (I-57 exit 327 East) in Peotone. Sat. setup 3 p.m.–11 p.m. Free overnight parking. Secured building. Main exhibition hall opens at 8 a.m. Flea Market electric hookup fee is $10. Electricity will cost $10 for 4 tables or less; electricity is free for more than 4 tables. One free ticket per vendor, all others, $4 in advance, $5 at the gate. For reservations, etc., contact *Dave Brasel NF9N, 6933 W. 110th St., Worth IL 60482.*

AUG 9

BARABOO, WI The 1st annual Circus City Swapfest will be held at the Sauk County Fairgrounds 7 a.m.–noon, rain or shine. Tailgate sales. Free parking. Admission $5 at the gate, $4 in advance. Tables $5 for 8 ft. (includes one admission) Electr. available. For advance tickets and tables, contact *Yellow Thunder ARC, 1120 City View Rd., Baraboo WI 53913. Check the Web site at [http://www.thelorax.com/~sschulze/hamfest.htm].*

AUG 16

ROANOKE, VA A hamfest/Computer Show will be held by the Roanoke Valley ARC, Sat., Aug. 16th, 9 a.m.–5 p.m. at the Exhibit Hall, Roanoke Civic Center, Roanoke VA. Setup at 6 a.m. with help available. Features include equip. dealers, free forums, two walk-in VEC exam sessions, and an indoor/outdoor flea market. Adm. is $5 at the door or in advance, outdoor tailgating $5, Indoor flea market tables $10 per table, dealer tables $20 ea. (plus $20 for electr.). Make checks payable to, and mail an SASE to *RVARC, P.O. Box 2002, Roanoke VA 24009.* Dealers and inside flea market contact *Claude KE4UVO, (540) 774-8971, or [ke4uvo@intrlink.com].* All others contact *Terry AE4EW, (540) 890-6782 or [ae4ew@ix.netcom.com].* Talk-in on 146.985(-).

SPECIAL EVENT STATIONS

JULY 3, 4, & 5

NEAR ROSWELL, NM An Amateur Radio Special Event Station will operate 1700 UTC–2400 UTC, daily, July 3rd, 4th, and 5th, to celebrate the 50th anniversary of the "Crash at Corona" near Roswell NM. Freq.: Approximately 20kHz up from the bottom edge of the General HF band edge, 6–40 meters (phone and SSB), and in the Novice/Technician (CW) HF section of 15 and 40 meters. Listen for W5BI, WB5LYJ, NA5N and WA5WHN. The station will operate overlooking one of the debris fields near Corona NM. SWL reports are encouraged too. SASE required. Send a 9" x 12" SASE and 2 units of US first class postage, along with your QSL card to *Jay Miller WA5WHN, P.O. Box 6552, Albuquerque NM 87197-6552 USA. Check the W5BI Web page for further developments, [http://www.flash.net/~w5bi/], or contact via the Internet, [wa5whn@juno.com].*

JULY 7–13

AUSTIN, TX Amateur radio operators affiliated with the American Assn. for Nude Recreation, the Naturist Soc., and the Federation of Canadian Naturists, will observe the 22nd annual North American Nude Awareness Celebration during the week of July 7th–13th. Special event stations will operate from naturist resorts throughout North America on the following frequencies: 7.265, 14.265, 21.365 and 28.465 ± QRM. For a personalized certificate, please send QSL and 9" x 12" SASE to *Bob Redoutey N5KF, P.O. Box 200812, Austin TX 78720-0812 USA.*

JULY 11–12

PORTAGE DES SIOUX, MO The St. Charles County ARES will operate KGØYJ, 2300Z July 11th–1700Z July 12th, during their annual field activation. Freq.: 3.870, 7.270, 14.270 and 28.370MHz. For a certificate, send QSL and a 9" x 12" QSL and SASE to *Bill Bird KGØYJ, 144 Ridgecrest Dr., Chesterfield MO 63017-2653 USA.*

JULY 19

SISTERVILLE, WV Tyler County Amateur Radio Organization will operate KC8GXI to commemorate the last working sternwheel ferry on the Ohio River. Operation will be 1400Z–2200Z. Freq.: 3.860, 7.230, 14.260, and 28.360. For a certificate, send QSL and a 9" x 12" SASE to *TCARO, P.O. Box 287, Middlebourne WV 26149 USA.*

JULY 19 & 20

STRATFORD, NY The Fulton County Dr. Mahlon Loomis Committee will operate W2ZZJ on July 19th and 20th to commemorate the 171st anniversary of the birth of Dr. Loomis, the American radio pioneer, who was born at Oppenheim NY on July 21st, 1826. Operation will be from 1300Z–2000Z on the General-class phone portion of 75, 40 and 20 meters, and on the Novice 10-meter phone band. Also, on area 2-meter FM rptrs. For a parchment certificate and extensive literature, send QSL, contact number, and a #10 SASE (55 cents) to *W2ZZJ, 5738 ST HWY 29A, Stratford NY 13470 USA.*

JULY 20

TOTTENHAM, ONTARIO, CANADA Members of the Central Ontario ARC will operate the "Radio On The Train" event for the 4th year in succession, 10 a.m.–4:30 p.m., EST (1400–2030 hours UTC). They will invite check-ins under the callsign VE3ZVT (the South Simcoe Railway Amateurs Station), and will be on 75 and 20 meters—frequency dependent upon current conditions—for HF, and for local traffic via rptr on 146.835(-) MHz, with 103.5 transmit subaudible tone. Operators checking in with the train can receive a memento QSL card of the event upon request. Club members operate from the caboose of the steam train at hourly intervals from Tottenham to Beeton.

JULY 27

NEWINGTON, CT The Meriden ARC, W1NRG, will operate CW and phone, from the W1AW station, 1400–1930 UTC, to celebrate its 50th Anniversary. Operation will be on the General portion of the 10-, 15-, and 20-meter bands and the Novice 10-meter subband. For a certificate, send QSL and a 9" x 12" SASE to *Meriden Amateur Radio Club, P.O. Box 583, Meriden CT 06450 USA.* 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form below for ordering information.

WGP87034 **All About Cubical Quad Antennas** by William Orr and Stuart Cowan "The Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. $13.95

TAB 3270P **Practical Antenna Handbook**–2nd edition by Jos. Carr. This 560-page book is a treasure. Starts with fundamentals, explains propagation of all kinds, and provides a ton of easy antenna projects. $29.95

WGP87107 **All About Vertical Antennas** by William Orr. Comprehensive coverage of amateur communications. $13.95

WGP87042 **Beam Antenna Handbook** by William Orr and Stuart Cowan. Everything you need to know about beam design, construction, and operation. $13.95

WGP87077 **Simple, Low-Cost Wire Antennas For Radio Amateurs** by Willliam Orr and Stuart Cowan. Low-cost, multi-band antennas; inexpensive beams, "invisible" antennas for hams in "tough" locations. $13.95

AR4661 **ARRL's Antennas & Techniques for Low-Band DXing** can be your ticket to low-band success. $20.00

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Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/5
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Baton Rouge LA 70817

Effective communications

One of the most fascinating aspects of amateur radio is its variety. There is literally something for everybody, from traditional Morse code to satellite communications, from experimentation to chasing DX. This diversity, naturally, attracts different people for different reasons, leading to a wide variety of operating styles, techniques and attitudes. Perhaps the biggest differences are because some hams are attracted to the art of ham radio while others are attracted to its science.

The science of ham radio includes all the nuts and bolts: the different modes available, techniques for optimizing the utility of each mode and, of course, the all-important gadgets that go along with such pursuits. Those folks attracted to the science are most comfortable with a soldering iron in hand, or a computer manual in front of them as they try to improve performance of existing equipment or develop new methods. These folks may be likely to tweak the equipment and then get on the air for brief contacts so they can determine how well the new system is working. In some cases, it's name, QTH and signal report, and little else, then back to the drawing board (or out to the antenna farm) to figure out the next modification.

On the other hand, those more attracted to the art of the hobby tend to be more interested in communications. In some cases, the equipment is viewed as an appliance to be used rather than as something to be disassembled, reworked and put back together. These folks often enjoy such aspects as rag-chewing, networks, public service or disaster communications. Many new members of the ham radio community start off on two meters, and local communications is among their first encounters with the hobby.

Now most of us are a mixture of these two aspects of the hobby, enjoying both the technology and the interaction. It is rare to find any amateur who doesn't get sweaty palms when reading about a new high-tech accessory for the shack. However, some hams see the equipment as a means to an end rather than the end in itself. This month let's focus on the communication aspect of the hobby, particularly as it relates to public service or disaster communications.

"The ham community is just that—a group of people with a common interest."

The purpose of such communications is to convey a message which is accurate, timely and complete—most importantly, to ensure that the recipient gets the meaning that the sender needs to convey. This is difficult enough when we try to convey our own thoughts, but even more so when acting as a communicator for someone else. In order to be effective in such a situation, here are a few guidelines:

• First, most of communications is *listening*. As hams, we often love to talk (or type or work a telegraph key), but in passing message traffic, most of the time will be spent standing by. A SkyWarn event, for example, is often hindered by operators getting on the air to give "fair weather" reports. Likewise, during disaster communications, the frequencies become jammed as everyone tries to get himself heard. The communications challenge is to limit oneself to providing *only* the information that is requested.

• Second, make certain that your message is understandable. Speak clearly and slowly. Be brief. Finally, use language which will convey the message. Creative phonetics, such as "King Easy Eight Yellow Noodles," for example, will just confuse other operators. What about "Q" signals? Traditionally, the use of Q signals is discouraged except when using CW. Personally, I have no problem with spoken requests to "QSY" or acknowledging a message with "QSL." Use of this lingo is a natural evolution for any hobby, particularly a technical pursuit. If I want a language which doesn't change, I'll choose Latin. The key question is, does a word or phrase help get the message across? If so, it probably should be used; if not, avoid it.

• Third, think about what you need to say before you say it. If you are used to rag-chewing on the local repeater, communicating during an event or for a third party is more demanding. Exactly who is sending the message? Who is the expected recipient? Exactly what is the message? There is no harm in taking a minute before you press the push-to-talk switch to collect your thoughts. In some situations it may even be appropriate to take a moment to rehearse before transmitting. This is true in any area of communications. For example, many student pilots are taught to practice what they're going to say before contacting approach control or the tower. Sometimes this is very helpful and saves stammering once on the air.

"Creative phonetics will just confuse other operators."

• Fourth, if you are communicating as a part of a net, follow the net's rules and procedures. If a formal net has been called, every operator is normally expected to contact only net control. Once you are acknowledged, then it is okay to give your information. If you need to speak with another station, the procedure is often to request to "go direct" with that station. Net control will either give you permission to do so and have you stand by, or recommend another frequency where you and the other station can speak directly.

• Fifth, be supportive. The ham radio community is just that—a group of people with a common interest interacting with one another. If you need proof, listen in on the various repeaters in a given area. Each repeater tends to have its own personality, reflecting the interests and styles of the operators who regularly use that machine. As a member of a particular community it is our responsibility to help one another out. If someone (particularly a newcomer) makes an error in operating procedure, help out. It is the opposite of communications to criticize another ham, especially over the very public air waves where other hams and people with scanners can all hear.

Finally, as the old joke goes, "How do you get to Carnegie Hall?" "Practice! Practice! Practice!" Although most of us are pretty confident of our own abilities to be effective communicators, the time to find out is *not* when a storm or other disaster has hit. Check into a local Amateur Radio Emergency Service (ARES) or Radio Amateur Civil Emergency Service (RACES) net on at least a fairly regular basis. Volunteer to help out at the local 10k or fun run or a parade. The Red Cross may operate first aid stations at various events, and rely on hams for communication. At Louisiana State University, for example, hams provide this communication support during football games, as well as enjoy a bit of Tiger football in the bargain. This will help you develop the skills you'll need, and have some fun while you're practicing.

Communication is not only part of the hobby—it's an aspect that makes us most useful to others. The amateur operator and his or her communication skills is every bit as important as the equipment we use. Tweak your communications skills as carefully as you tune your equipment. It is the combination of both that makes us the most valuable. 73

Let's Keep CW Alive!

It's distinctive, it's useful, and—most of all—it's fun!

Arthur R. Lee WF6P
106 Western Ct.
Santa Cruz CA 95060

The skipper, Terry Parks N6NUN, pointed the bow of his 32-foot Grand Banks trawler toward Monterey and headed out into the cold, choppy water of the bay. Before going below for a hot cup of coffee, I asked him if he would put up his 15m whip antenna so that I could work a little CW. I enjoy being on the air when we are at sea and wanted to play around and make a contact or two. I sat down at the navigator's station, fired up the rig, tweaked the auto tuner a touch, and casually sent out a CQ. The feel of his key in the rolling sea was comfortable at about 12 words per minute so I stayed at that speed. To partially drown out the noise of the big diesel, I pressed the earphones closer to my head. After I tapped out only one call, a moderately readable station came back almost immediately. We chatted along, exchanging the usual information. My QTH, a maritime mobile in Monterey Bay CA; his QTH—*Romania!* I was so startled and delighted that I nearly spilled my coffee! After about 15 minutes, the band faded so we signed off. But we could never have made the contact on voice mode. Needless to say, Terry and I were pretty excited about the QSO.

Anyone for CW?

CW is a viable and useful language, something we hams can be proud of using. It's a great language, music to some, and a specialized communications skill that sets hams apart from the rest of the population. If we stop to consider, it is the common bond among amateurs that makes us a unique and truly distinctive group. At one time or another we all worked hard to develop our initial threshold speed of 5 wpm, yet a recent informal poll of a California amateur radio club disclosed that about half of the respondents rarely or never used CW.

As with any language, code must be practiced regularly to attain even the lowest degree of proficiency. One has to be comfortable with the mechanics of a language before enjoyment sets in and CW is no exception.

The Novice Enhancement Program opened up a portion of the 10 meter band to voice. This effectively short-circuited the past CW training period for Novices, allowing them to go straight to voice. This, then, can become a trap, just as attaining the Technician class license and acquiring 2m capability was for many hams over a multitude of many years in the past. As an enticement, and on the positive side, the major benefit of 10m voice privilege is that it gets many people on the air who might not be if forced to use CW. To some amateurs, CW is a painful experience and to be avoided at all costs. It doesn't have to be that way. In fact, CW can be (and is!) a lot of fun once it is mastered.

In many discussions with hams, there seem to be several basic reasons for not using CW. These generally are given as:

1. My code is rusty.
2. My code speed is too slow.
3. I don't know the proper procedures.
4. I don't know what to say.
5. I don't want my friends to know how bad I really am.

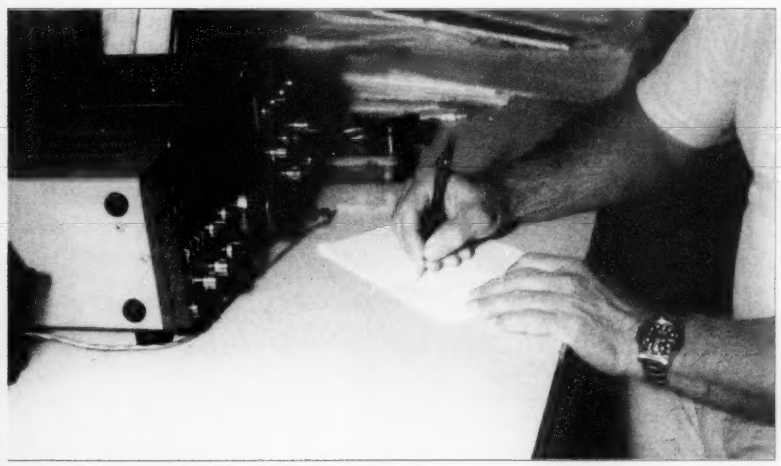

***Photo A.** Copying code off the air can get you back up to speed. Leave the rig tuned to a CW practice station as background music to get your mind used to hearing code.*

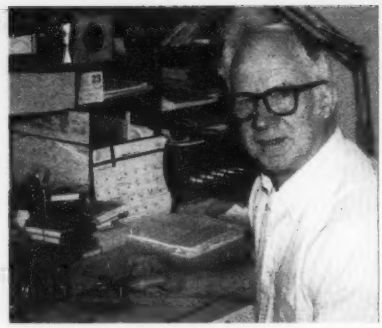

Photo B. *The author, copying CW from W1AW code practice broadcasts. Send out a CQ on your own or return the call of someone who is sending at your speed of copy. Don't be in a rush. Slow copy is fine and gets you going again.*

6. (Now get this one!) I can't spell.

These reasons are valid to those giving them, but they can be overcome with a little bit of effort. Reason number six is easy to get around. First of all, few of us can correctly spell every word we use in our daily conversations so why worry about it? Do your best, abbreviate when possible, and lastly, if this is any comfort, you can assume that the receiving operator won't mind a few misspellings. Offer a few "HI HIs" and let it go at that.

Things to do

Here are a few suggestions that might help increase your on-the-air proficiency and enjoyment of CW:

1. If you haven't been on the air with CW for awhile, a few minutes of off-the-air practice sending will shake out some of those cobwebs. Dust off the old key and code practice oscillator, relax, and send plain text out of the morning newspaper while having your morning coffee. Tape your sending for a later playback while on your way to work. Be sure to include a generous amount of mixed numbers. Telephone numbers in the classified section are a good place to start. Work in some callsigns from contest winner listings found in back issues of ham magazines.

Photo C. *Bob Brouwer N6HLE, operating his ham rig aboard his 32-foot sloop,* Cybele II. *Bob uses a straight key when at sea as a maritime mobile, but prefers his bug for shore use.*

2. After a few of these solo practice sessions to build up your confidence in getting those tough "L"s, "F"s, "G"s, and "W" sorted out again, turn on the receiver and copy some "easy-listening" code at *your* speed. Take it slowly at first, but don't spend more than 10 minutes at any one sitting.

3. Make a habit of turning the rig on to CW whenever you are in the shack. Use CW as background music and make no conscious attempt at copying—your subconscious mind will absorb the sounds of the characters by osmosis.

4. Work a CW contact by answering a CQ at your comfortable speed. Go ahead and answer—the sending operator, in most cases, won't bite you. Remember, he or she must want to talk to *someone* or they wouldn't be calling CQ in the first place! You can be that someone. This is a case where talking to strangers is encouraged. I tell my ham radio students that "Slow is good!" You don't have to be a speed demon to enjoy CW. Good, slow, code is a pleasure to listen to.

5. Make a commitment to yourself to work at least one CW contact within a given time period. Once or twice a week is fine to begin with. The object here is to use the skill in an established routine. The QSOs can be short, but fun contacts are inevitable.

6. Help a Novice. We were all Novices once. Get on the Novice band and work with someone who is struggling with the code for the first time. Help them overcome their fear of being self-conscious about their early efforts. Give them a few helpful tips if you can. Novices can benefit from your past operating experience. Remember, you have been in this hobby longer than they have.

7. Set up a CW sked with a friend. He or she could live down the street, across town, or thousands of miles away. You can help each other. When I first learned the code, I had the key in one hand and the telephone in the other, repeating back a string of numbers or callsigns my radio friend had just sent.

8. As your confidence with CW grows, push yourself a bit. Copy W1AW and some of the better code operators at speed higher than you think you can copy. Stretching is good exercise.

9. Take a chance. Contact someone who sends a bit faster than you can copy. Send a QRS if things get sticky. They will be glad to slow down if you only ask. After awhile, you will be pleasantly surprised that you can copy faster than you thought.

10. Initiate your own CQs. Grab the bull by the horns and go for it. You know what to do—you yourself have been trained by someone at one time or another. It is probably good to remember that you can do no wrong, a far as protocol goes. A CW friend once told me to pretend you are simply talking, only you are using your new language. About the only procedural rules you will have to observe will be to stay within the ham bands and to send your callsign at the proper times. Use the rag-chewer's tried-and-true guideline of just saying anything that comes into your mind!

As for voice communications, anyone can talk and most of us have been doing this since about age three. Household telephones and voice bands are excellent means of transferring information, yet, as hams, we must not overlook the bond that holds us together. We have that rare something that not everyone has—the ability to make ourselves understood in a unique way. CW is far from dead and can be richly rewarding if we work at it a bit. Give it a try—only through regular use can it be made easy. 73

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Help for College-Bound Hams

Apply for an amateur radio scholarship.

Matt Minney N8PGI
Rt. 1 Box 126
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Students entering college are *always* interested in extra money. A ham radio operator has several options for finding college scholarships, and the opportunities are growing every year. If you qualify for one of these scholarships, you'll be one step closer to paying for your college education. The requirements for applying for a scholarship are generally not prohibitive and simply require filling out an application for review by committee.

What's available?

Amateur radio scholarships generally come from one of three sources: The ARRL Foundation, the Foundation for Amateur Radio, and Dayton Amateur Radio Association. All work in a similar manner, but each one has unique characteristics.

The Dayton Amateur Radio Association, the group that sponsors the Dayton Hamvention, offers several scholarships to students who graduate from high school in the year for which they are applying. These scholarships are about $2,000 per recipient.

The Foundation for Amateur Radio, located in College Park, MD, represents nearly two dozen organizations with diverse requirements and awards. The requirements vary for each scholarship, but several of these are available for every amateur. Some scholarships are available only to hams in a specific field or particular geographic area, such as a county or a state; in this case, being a graduating high-school senior is not required. The available amount begins around $500 and peaks at $2,000.

The last of the three major sources is the ARRL Foundation. This group is supported by the ARRL, and is based at ARRL Headquarters in Newington, CT. The ARRL Foundation also offers a variety of scholarships that have different requirements for eligibility. There are both general scholarships and those targeted to specific groups of hams. These again have geographic or academic restrictions. The scholarships available could again vary from $500 to $2,000.

What's involved?

Although each of the three major organizations has somewhat different rules and procedures, the processes are basically the same. There are usually about five general parts in most applications: a basic application, financial information, references, a transcript, and an essay, paragraph, or some other example of written material by the applicant. These may be part of the main application or separate forms, depending on the application.

"Work out your answers on a separate sheet of paper before you fill out the application."

Filling out the main application is the most important part of the process. This part of the process includes personal information. Questions that will appear include basics such as the person's name and the name of the institution that is being applied to. There are also questions about the applicant's academic career and standardized test scores. I suggest that the applicant work out the answers on a separate sheet of paper before filling out the application form. This will allow polishing any answers. Open-ended questions that ask why you and not someone else should receive the scholarship require serious thought.

A statement of the applicant's finances is a relevant question in scholarship applications. The best source to answer this question is last year's tax returns. The application will also want a projection of the need for the upcoming school year. Before giving a final figure include *any* realistic expenses that might be encountered, not just the tuition. Finally, some applications ask for information about other items such as special needs and real property such as cars. Be honest when answering these questions, but be careful to not provide answers that you believe the committee wants to hear.

The third component of an application for a scholarship is a set of references. Usually these references will come in two forms; one being for some aspect of the candidate's personality and one recommendation for a specific scholarship. The references for one's personality or character could entail as many as three different sources. Make every effort to include any information that will make it easier for the committee to locate your reference. It is a good idea to talk to your references ahead of time so they are prepared for the possible phone call. Secondly, some specific scholarships require a recommendation from a member of the sponsoring organization. Try to find a member in a local club or area net if there is no member of the organization in the area.

The fourth part of most scholarship applications is a transcript. There may not be a transcript requirement, but including one is a good idea. A high school student should ask the guidance counselor to provide a copy if needed. This will help to answer some questions about overall grade point average or test score questions.

The last major part of a scholarship application involves some sort of writing. This is a broad category that might range from a separate description of yourself to a paragraph that is the main application. This gives the scholarship committee some idea as to the applicant's writing ability and a hint about the

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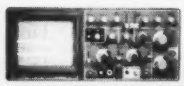

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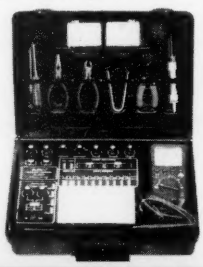

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person behind the application. It is a good idea to include as much in the space as allowed, but make sure that the included material is something that the committee needs to know. Again, write as many drafts as needed on scratch paper, then present the best answer.

Helpful hints

A minor detail might not be the difference between receiving and not receiving a scholarship, but it is always good to generate as few problems as possible. Minor changes can make the application easier to read and more attractive to the committee.

A typed application is generally appreciated by most people, unless the applicant has excellent penmanship. There are two major benefits to typing the paper. First, it will be easier to read, and the second is that the application will appear much neater. Another simple hint is to finish the application as quickly as possible. This means asking for the references and transcripts ahead of time. This also gives the applicant time to make minor changes as needed. Writing out the answers to the application questions on a separate paper will make revisions much easier. Most applications require a copy of the applicant's amateur license, so be sure it is included.

Once the application is complete, make a last-minute checklist of all the elements that need to be included. Check the address and send it in several days before the due date. A late application may not be accepted. Scholarship winners will be notified by phone or by mail as to the specific scholarship and the amount. Winners may also be recognized by an amateur magazine or brochure. Instructions as to how to receive the scholarship will also be included in the notification. This usually involves sending the check to either the winner or to the institution listed on the application.

Any ham radio operator planning to continue his or her education beyond high school should consider applying for a scholarship. There are no guarantees of receiving any help with college expenses, but a well-done application is a definite step toward being the winning applicant.

I would like to acknowledge the use of each organization's scholarship materials in the creation of this article. I also wish to express gratitude for the help they gave to me in the completion of my college degree.

Continued from page 31

outsource, there's a huge and growing need for the creation of new jobs.

The main problems facing entrepreneurs in starting new businesses (unless they've read my book, *Making Money, A Beginner's Guide*, and have followed my instructions) are getting funding and gaining the business skills needed for success. I have a sneaky proposal for helping to solve both of these problems.

The idea is to get a group of synergistic businesses together to form a support group. Almost all small businesses need support services such as lawyers, accountants, computers, office equipment and supplies, printing, advertising, maintenance, waste removal, telephones, insurance, office space, and so on.

Using the business expertise of such a supporting group, say as a board of directors, a new business can hardly fail. And since it doesn't cost a lot to get a new small business going, the startup funding could come from a fund put together by the supporting group. I'd call it a consortium, except for the negative connotations of "con," so let's call it a "pro"sortium.

Step two for the support group would be to get their state to set up a small business development administration to provide the needed funding—and to do this on a for-profit basis. I would ask the support prosortiums to indemnify the state for any losses. This would act as a filter to weed out questionable startups.

Clubbing Us

Proof that Wayne's basic guide to politics (Never Re-elect Anyone) works with your local ham club as well as a way to flush the Washington toilet you've allowed to back up arrives almost daily in letters from readers. Like how about the club president who has ordered that the club phone patch is for emergency assistance and not a substitute for a cellular phone? Sure, we do almost as well as CB when it comes to dealing with emergencies, but this is still a hobby and that means it's supposed to be fun. If the club repeater tends to get bogged down with club members making calls to their families, then put in another repeater. Good grief!

How much of an effort have your club officials made to bring in youngsters? Most of the clubs I've visited are almost all peopled with old men with one foot on a banana peel and the other already in the grave. There'll be lots of good deals on used ham gear soon. A few years ago I remember being amazed when I spotted a youngster wandering around at Dayton. Wow!

Mooned Again

A press release from the SETI League announced their collaboration with the Artemis Society with the goal of placing a radio telescope on the back side of the Moon. In order to buy into this project one has to be a pathological skeptic about both UFOs and contactees. Which, to my mind means that one has to be severely unread on the subject.

I often marvel at the blind spots many scientists have—at their inability to even investigate anomalies which to me are crying out for attention. Heck, I reported around 30 years ago in my editorial the results of my investigating a local crop circle. I interviewed the family living next to the field and heard about a UFO which silently hovered over their home for several minutes before going up and circling the nearby Crotched Mountain Rehabilitation Center, where it was seen by hundreds of people.

I do have to admit, as I've read the stories of contactees and talked with several personally, that I'm damned annoyed that I haven't been picked by the ETs for the experience. Perhaps they recognize that I'd keep them too busy answering my questions to be of much help.

Either a bunch of people, many with some impressive credentials, are secretly crazy, or the contactee experience is a reality. And that means that the aliens are not only here, but that they've been visiting us for a long, long time. I suspect our recent technology advances may have increased their interest, hence the recent step-up in sightings of UFOs and our hearing more about contactee experiences.

Now, getting back to the Moon. Until I see some good solid scientific refutation of the case René has made that we've never been to the Moon, the idea of human space travel beyond a near orbit inside the protective shield of the Van Allen belt seems implausible. So the whole concept of installing and manning a radio telescope on the Moon's butt seems to me like just another scam to solicit funds from the uneducated credulous.

The Ham Impact

I keep rattling on, preaching to the choir about how much adventure amateur radio has brought me. So how about you? How has amateur radio changed your life? In business? In adventure? Friends? Get busy at your word processor and write about it. Give me some ammo to use in selling kids on our hobby. I'd love not just to print an article in *73* on the impact of hamming on your life, but maybe to gather a bunch of stories into a book so we can reach out and get the public aware of what a powerful hobby we have.

Even skiing down the slopes in Aspen this last January with some local hams was an adventure for me. English is an impoverished language when it comes to expressing feelings, so I can't adequately describe the thrill that I get when I'm zooming down a mountain with friends. Sure, bowling is fun when you're good at it, but skiing provides a rush that's beyond words. It's addictive.

So tell me about the adventures that amateur radio has provided you—how it's provided you with a career path. And get cracking, I don't want to have to keep reminding you, fighting your almost legendary ability to procrastinate.

Those ARRL Proposals (Rearranging the Deck Chairs)

You've probably read or heard about the rule changes the ARRL has suggested.

Look, there's one simple problem that has to be solved if amateur radio is going to be saved from extinction. We either get a whole lot more hams or we get blown away. Alas, to no one's surprise, the ARRL proposed rule changes are insignificant tinkering—designed more to create controversy among the hidebound than to solve our problem. It gives the facade that the League is doing something.

There are two major reasons why the public interest in amateur radio has gone from a bright fire to a small spark—from the time when there was prestige in being a ham to today's public yawn, they're not too sure what ham radio is. Reason number one is an almost total lack of promotion of the hobby. Number two is the continued maintenance of the code as what is all too often perceived as an insurmountable—a hazing—obstacle.

Sure, back in the 1930s, when I got interested in the hobby, and 90% of all ham contacts were via CW, there was some rationale for making sure that new hams knew the code. It didn't make a lot of sense to me then, since if I wanted to be active on CW I would have to learn the code, with or without a code test as part of the qualification.

Lowering the 13-per test to 10-per isn't going to do anything magic. Sure, the League will be able to continue to make money selling code courses, but it isn't likely to attract many more hams.

We need articles about hamming in the newspapers, in popular magazines, on TV, and so on. When I get on the Art Bell show and talk about amateur radio, I get thousands of letters from listeners wanting to know more. We have one of the best hobbies there is, and I've had a bunch of hobbies, so I know what I'm talking about. Amateur radio can help to provide a career path for youngsters that's right in tune with the times. It can provide adventure for hams of any age. As I keep explaining, amateur radio has provided me with a lifetime of adventure and friends.

What could be more fun for a ham than publishing a ham magazine? I've used that platform to visit hams in over a hundred countries and to operate from some really weird places. It was my contacts with Robbie 5Z4ERR in Nairobi that got me to organize a ham hunting safari. What a blast that was! Wow! I still remember the moment when Larry slipped on the wet moss and came tha-a-at close to falling into Murchison Falls in Uganda! And it got me to be a member of the US delegation at the International Telecommunications Commission in Geneva. It got me two weeks of operating from the king's palace in Amman, along with dinner with the king and queen of Jordan. It got me operating a ham station from the US Embassy in Iran, and from the DMZ between North and South Korea.

My success in helping ham repeaters with endless articles and books turn into a leading ham activity, which then spawned cellular telephones, got me to start *Byte* to help personal computers grow from a curiosity into a new industry.

And there isn't anything that I've done that anyone else couldn't have. I didn't start out with any money from my family. I always just barely squeaked by in school. Well, I did get involved with extracurricular activities a lot. Like the radio club, the Savoyards (singing Gilbert and Sullivan), the Choral Club, the Philharmonic Choir of Brooklyn, the camera club, stuff like that.

So, after all the adventure amateur radio has provided me, I really hate to see the hobby being destroyed by the League —through a religious obsession with the code and an almost complete neglect of promotion.

Books for Crooks

The Art Bell (W6OBB) show hits all 50 states, plus a good deal of Canada, via around 335 AM radio stations. The downside is that he's on for five hours starting at 11 p.m. Pacific time. That's from 2 a.m. in the east. Art's interviewed me three times so far and, judging from the response, his audience is biased towards older people, who tend to have trouble sleeping, truck drivers on long-haul trips, and prison inmates.

I encourage the people writing to tell me something about themselves. I've been surprised at the literacy and intelligence of many of the letters from prisoners. But they have a big problem: no money. Many really want to educate themselves, so they've been sending stamps to buy my guide to self-education, which is a review of around a hundred books about things they don't teach in school, but should.

These are not the kind of books they're going to find in their prison libraries, so how can they take the next step? I'd love to try and do something about this, but I can't handle everything I've already signed up to do. I envision a "Books for Crooks" program, run by some altruistic retired person who would like to score some points with St. Peter. The idea would be to buy some books and send them to inmates who will (a) promise to read them; (b) make notes on the contents; (c) return them within a week; (d) and pay $5 for each book they've read into a revolving fund after they've been released.

The program would need one person to handle the "rentals," and someone with the bucks to endow the startup of the operation. A hundred books might run $1,000 for the original inventory, though I'm sure that many publishers might cooperate with big discounts.

Of course our whole prison system needs an overhaul. It is *not* correcting behavior. And, as I'm sure you know by now, America has the largest percentage of its population in prison of any country in the world. Is that a hint that we have a problem? Please let me know if you're interested in helping to solve this problem. It needs to be done and I'm beginning to realize that I can't do everything.

Guts

After reading a bunch of letters from Art Bell show listeners, many from hams, I feel like preaching. The basics of my sermon today are simple. First, our educational system is not educating. Second, our health care system is not keeping us healthy. Third, our monetary system is a fraud. Fourth, our "correctional system" doesn't correct anything. Fifth, our Congress is mainly a bunch of ex-lawyers getting rich on bribes from lobbyists. Sixth, the administration isn't any better. And unless you have the guts to do something about it personally, amateur radio is going to go down the tubes with our frequencies sold to the highest bidders, which aren't going to be us. The ARRL is doing almost nothing to help save our bands, so who does that leave?

Oh, you whine, but what can just *one* person do? Step one is to do your homework so you know what you are talking about. Step two is to get yourself into gear and start making things change. One person can make a hell of a difference; it's just that so few people ever try. The movers and shakers do just that—they move and shake things up. But first you have to know what you are talking about and where best to put the pressure to get change.

It's a lot of work to become a world expert on some subject, but ridiculously easy to become an area expert.

Know what you're talking about and then start talking—and writing. Raise hell and put a brick under it. Our school system doesn't have to be one of the worst in the developed world. Our health care system doesn't have to be worse than many third-world countries' *and* be the most expensive in the world. Our prisons don't have to house the largest percentage of our population of any country in the world. You *let* all this happen. We don't have to have more government workers (and I use the term loosely) than we have in manufacturing.

Find out for yourself why any one of these disgraces has happened and start doing something about it.

Maybe you'd prefer to start with something less intimidating—so how about finding out for yourself what the situation is regarding the potential life of amateur radio? Don't believe me—do your homework—then start doing something about it.

All it takes is guts to change things. Got any?

Distant Learning

Technology is improving our ability to learn wherever we happen to be. We have books, audio tapes, video tapes, and TV. My favorite is books. You can't highlight audio or video tapes, or get to the part you want quickly via an index. And you can't throw nearly as much information into your suitcase when you're off on a trip. I always have a stack of books with me when I travel.

There are some things which really require video, like the learning of some skills. A few years ago I had the idea of putting the whole K-12 curriculum on video tapes, with each course being taught by a performer so it would be exciting. Even the otherwise most boring courses can be made exciting by a good performer. In this way the very best teachers in the world could be tapped. The unions would fight this to the death.

I had this crazy idea that this would be a great project for a university, providing K-12 courses for any parents really interested in seeing their children actually learn and have fun doing it. Kids could leave their classmates behind in the dust. As John Taylor Gatto, the prize-winning teacher, points out: It only takes about a hundred hours for a child to learn to read and write.

John quit teaching, saying that he couldn't keep doing that to the kids. I've reprints of two of his talks, which go into what's wrong with our school system and why it is doing so much damage to our kids. $3 from Radio Bookshop.

Another War Lost

Hmm, let's see now. Which president declared a war on drugs? Well, we lost it. Johnson declared war on poverty. Another lost war. Nixon declared war on cancer. So here we are 26 years later, with $32 billion supposedly spent on cancer research, and more people are dying from cancer today than in 1971. Those vaunted cancer drugs? All they do is give the patient a few more months of painful life. One in three Americans will get cancer and a half million will die this year.

Cancer, as I've mentioned before, is not caused by God. We do it to ourselves through poisoning our bodies and malnutrition.

Poisoning ourselves? Like smoking, for instance. Malnutrition? Just look at the junk people are taking through the checkout counters at the market for their families and you'll see why heart disease is the number one killer, with cancer closing in fast. You wouldn't mistreat your car the way you do your body. 73

Radio Bookshop

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As I write these words in mid-April (and you read them in June), July propagation is particularly difficult to predict. Last week, Old Sol suddenly awakened from his long sleep and produced major solar flare activity—the greatest in years—accompanied by groups of sunspots breaking out on the solar disc. While this is encouraging news, the old saying "one swallow doesn't make a summer" still applies, because there is no assurance that the renewed activity will continue or increase over the next three months.

However, my best guess is that the ho-hum conditions of the past two years have changed and we can expect to see greatly increased DX opportunities beginning this fall.

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RUSSIA (C.I.S.)							20	20		20		
SOUTH AFRICA			40	40		20	20				20	
WEST COAST	20	40	40	40	40	40	40					20

CENTRAL UNITED STATES TO:

ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40	40		20			20	
CANAL ZONE	15	20	20	20	40	40	20	20	15	15	15	10
ENGLAND	20	40					20	20		20	20	20
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40	40	20	20	15	15	15	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40	40	20	20	15	15	15	10
RUSSIA (C.I.S.)								20			20	
SOUTH AFRICA							20				20	20

WESTERN UNITED STATES TO:

ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40	40		20		15	15
CANAL ZONE	15	15	20	20	40	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20	40	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20	40	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20	40	40		20	20	15	15	15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA			40						20			
EAST COAST	20	40	40	40	40	40						20

JULY 1997

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G-F	2 F	3 F-P	4 P	5 P-F
6 P-F	7 F	8 F	9 F-P	10 P	11 P-F	12 F
13 F-G	14 G	15 G	16 G	17 G	18 G	19 G
20 G	21 G-F	22 F-P	23 P	24 P	25 P	26 P
27 P	28 P-F	29 F	30 F	31 F		

This month's calendar shows seven days when propagation is likely to be Fair, six Poor days, seven Good days, and eleven trending days: four trending toward downward and seven trending upward.

The 4th, 10th, and 23rd through 27th are likely to exhibit a very uncooperative and disturbed ionosphere because of other geophysical upsets occurring on earth, such as unusual weather and the onset of a violent hurricane season, for example.

Your best DX opportunities are likely to occur between the 14th and 20th, so stay alert and make the best of your chances during this period. Since July is the beginning of the vacation season, and mobile-portable hamming is at its peak, plan on having lots of fun with both DX and short skip wherever you may be! W1XU.

Band-by-band propagation this month

10–12 meters

Occasional intense sporadic-E propagation may provide openings to 2,000 miles or more, while frequent short-skip openings out to 1,000 miles or so can occur on Good (G) days.

15–17 meters

Frequent short-skip openings to 1,500 miles and occasional long-skip openings on north-south paths across the equator are expected on Good (G) days.

20 meters

DX to all parts of the world can be expected on this band from sunrise to sunset on Good (G) days, with peak conditions usually occurring a few hours after sunrise, and again in the late afternoon. Short skip to 2,000 miles or so may be expected as well.

30–40 meters

Consistent nighttime DX to all parts of the world is expected from sunset to sunrise, with possible exception of poor reception due to high static levels during thunderstorm activity. Short-skip openings averaging 500 miles during the daytime and 1,500 miles at night are anticipated.

80–160 meters

Nighttime DX on 80 and 160 can be fair this month, with the exception of high noise levels on both bands from thunderstorms. Daytime short skip of a few hundred miles is possible on 80 but not on 160. Short-skip propagation is expected at night on each band, and ought to be fair out to perhaps 1,400 miles or so, but limited by QRN. 73

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The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the October 1997 classified ad section is August 12th, 1997.

Audio Equipment wanted. 1930s - 1960s. Tube-type amplifiers, large or small speakers, mixers, microphones, tubes, parts, etc. Especially Western Electric, Jensen, Marantz, McIntosh, J.B.L., etc. **1-800-251-5454.** BNB202

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